

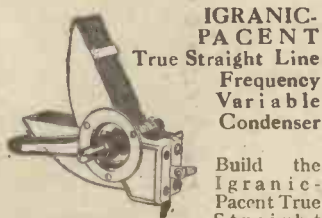
You need these IGRANIC RADIO DEVICES—NOW!

Perhaps you have already felt the need for making certain changes in your receiver. Those distant stations which came in easily during the winter months cannot now be found. It is necessary for you to ensure that the components in your receiver are of the highest efficiency, and possibly the addition of a stage of H.F. amplification will help you to maintain the good all-round reception which is now so difficult to achieve. With the coming of summer, it is more than ever necessary to

guard against lightning by fitting an efficient earthing switch. Then, there is the need for a portable set so that you may gain the fullest pleasure from days in the open-air combined with the joys of radio music.

Igranic Radio Devices will enable you to fill the foregoing needs—and many others—with perfect satisfaction.

Here are a few of the most interesting Igranic and Igranic-Pacent components—your dealer will show you the complete range.



IGRANIC-PACENT
True Straight Line
Frequency
Variable
Condenser

Build the Igranic-Pacent True Straight Line Frequency Variable Condenser into your receiver, and you may feel confident that the energy in your aerial is being utilised to the best possible advantage, thus ensuring maximum signal strength. Further, the perfect ease of tuning afforded by the even distribution of stations over your condenser dial will make reception a real pleasure. Prices: '00035 mfd., 14/6; '0005 mfd., 18/6.



IGRANIC
High-Frequency
Transformers

Fit these Transformers and be sure that your H.F. amplifier is operating at maximum efficiency. They incorporate the well-known honey-comb duolateral form of winding, and possess electrical features which are conducive to highly satisfactory results. They will enable your set to "reach out" for those distant stations which are now becoming so difficult to receive. Fitted with standard 4-pin mounting & made in four sizes covering wave-lengths from 288 to 3,200 metres when tuned by '0005 mfd. condenser. Prices, 8/- to 12/6.

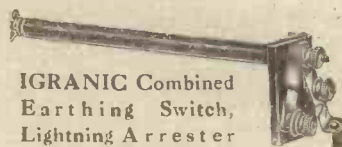


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COILS

The new Igranic Coils with real low-loss features.

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A highly efficient "lead-in" device, affording perfect protection against lightning and static discharges, and simplifying connections. The ebonite lead-in tube is 10 in. long, and all metal parts are heavily nickel plated. Price 6/6.



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The Igranic-Pacent Rheostat affords extremely satisfactory filament control for any type of valve. Its robust construction and dependability enable it to stand up to hard wear, while its small size renders it very suitable for use in portable sets. Resistances of 6, 10, 20, 30, and 50 ohms are available, at the reasonable price of 2/6 each.

All reputable dealers stock them

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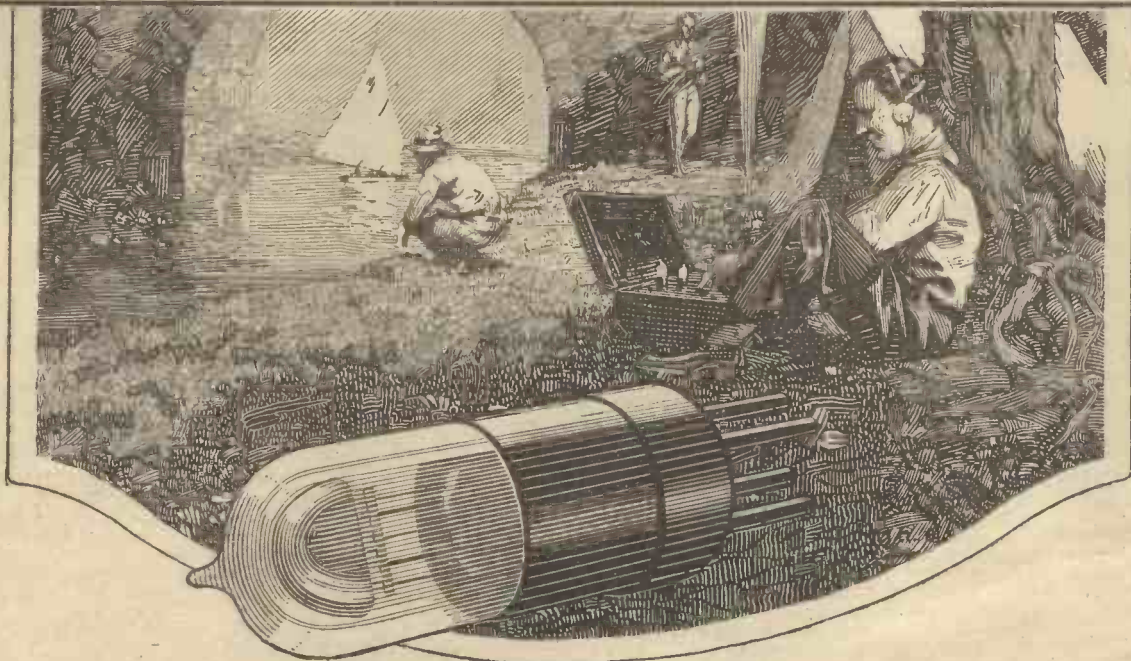


Pacent Radio
Essentials

149, QUEEN VICTORIA ST.,

LONDON. WORKS: BEDFORD

The Dull Emitter which popularised Summer Radio



SO long as bright-emitter valves were the only ones available the really portable Receiver was impracticable. No one wanted to carry big 6-volt accumulators out into the country for the pleasure of enjoying a Radio concert in the meadows—it wasn't worth the trouble. And even when the first dull emitters became more popular their extreme fragility rendered them unsuitable for the inevitable rough handling which every Set must get when carried from place to place.

And so the portable Receiver lagged in development. But, with the introduction of the Wuncell, summer Radio becomes a new delight. It is now quite easy to design a three-valve Receiver which can be fitted into an attache case complete with a 2-volt unspillable accumulator. Such a Receiver will give at least 10 to 12 hours' reception on one charge. And, what is more important still, the

Wuncell valves will not be harmed by the vibration and rough usage to which such a Receiver must inevitably be subjected.

The reason for this lies in the design of the filament and its method of manufacture. Instead of being a long, straight filament, it is arched and further stayed at its centre with a third support. Instead of obtaining low current consumption by thinning down the filament at the risk of fragility, the Wuncell filament is manufactured under an entirely new process. This permits an exceptionally high electron emission at a temperature of only 800 degrees—when the Wuncell valve is working, its glow is practically invisible in daytime. Even in the dark it is no more apparent than the luminous figures on a watch dial. As a result, therefore, we have every confidence in saying that the Wuncell Valve is quite as robust as even the well-known Cossor Bright Emitter.

Types and Prices:

- *W.1. For Detector and L.F. use - 14/-
1.8 Volts. Consumption .3 amps.
- *W.2. (With red top) for H.F. use 14/-
1.8 Volts. Consumption .3 amps.
- W.3 The Loud Speaker Valve - 18/6
1.8 Volts. Consumption .5 amps.

*Also in special base with resistance to suit 2, 4 or 6-volt accumulator 16/-

Cossor Valves

Popular Wireless

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RADIO NOTES AND NEWS.

German Super-Station—Imported Programmes—More Covent Garden Opera—Four Stations in One—Trans-World Congratulations—A Radio Hoax.

Imported Programmes.

ARE Continental programmes worth relaying? This month will probably see the question decided, for the B.B.C. is trying a once-a-week dose of this fare, which will be continued hereafter if the listening public approves. The "imported" programmes will be picked up at Keston and relayed every Tuesday during June.

If the programmes themselves please you, and the quality does not suffer en route, you should drop a line of appreciation to the local station. The experiment will only be retained as a regular feature if there is a demand for this class of overseas fare.

The Boatswain's Mate.

ON Saturday, June 5th, the Newcastle Station Repertory Players will broadcast "The Boatswain's Mate." This is a comedy by W. W. Jacobs and H. C. Sargent, which should come over very well, the humour being of the broad and hearty brand that is especially suitable for the microphone.

Listeners to Hear the Prince.

IT is expected that when the Prince of Wales speaks at the dinner of the African Society—which is to be broadcast on June 9th from the Savoy Hotel—his subject will be his recent trip to Africa.

The speech of Earl Buxton, at the same function, will also be broadcast.

Germany's Super-Station.

A NOTABLE addition to the Concert of Europe is the great new broadcasting station at Langenberg, which is to be opened this summer. It will be the broadcasting boss of Europe, with a power of no less than sixty kilowatts!

Langenberg is about a dozen miles from Cologne, and the new station will therefore be well situated to cover the Rhine and Ruhr districts.

Europe's Best Broadcaster.

WHEN this new German super-station starts up, the two existing stations at Dortmund and Elberfeld will be unnecessary, and will probably close down. Langenberg will rival 5 X X for the honour of being Europe's most popular station,

and its audience will certainly be a vast one, for the crystal range will be well over 100 miles. The wave-length and call sign have not yet been announced.

The New "Editorials."

HOW do you like the B.B.C.'s stunt of giving out an "Editorial" before the news is announced? Personally, I must admit straight away that I don't



A recent photograph of Mr. Harry Faulkner, the Engineer-in-Chief of the Hillmorton Station.

like it at all; but, of course, that may be because, to me, it is too much like talking "shop." Not many readers have yet expressed their views upon the subject, so if you happen to be writing in I should be glad to know your opinion of this innovation.

Bournemouth Municipal Orchestra.

A PROPOS of the recent announcements regarding the cessation of the Hallé concerts, a Hampshire reader raises the question of whether a parallel situation will arise in connection with the Bournemouth Municipal Orchestra? Inquiries made locally elicited the opinion that there was little likelihood of a similar claim being

made. Members of the orchestra receive no extra fee for broadcast performances, but the Corporation receives £21 per concert. When the present contracts expire the question of paying a small extra fee may arise, but 6 B.M.'s popular municipal broadcasts are not likely to cease on this account.

Wireless Wisdom.

IN spite of all its inventions, is humanity any wiser now than a hundred years ago? asks a contemporary. I think so. If television comes it will make "seers" of us all in no time.

Four Stations in One.

THE great Post Office Wireless Station at Rugby is really four different stations rolled into one. There are two main transmitters there (one for short waves, and one for long), either of which is capable of world-wide range. Then there is a long-wave transmitter of medium range, which is kept pretty busy most of the week. And finally on Sundays there are the tests of the experimental telephony transmitter. This latter is on speaking terms with any place within 4,000 miles of Rugby, so altogether the Post Office can claim to have put up a four-fold station unequalled in the whole world.

Looking for Laughter.

WE waited a long time for the Village Concert, featuring the Vicar of Mirth, but it was certainly up to expectations. Not a few listeners have told me that it was the most enjoyable programme for months, and I am more than ever convinced that microphone-mirth is the biggest need of broadcasting to-day.

I happen to know that the B.B.C. is eagerly looking for a laughter-maker—someone who will fill the studio with new side-splitters. Can you put them wise to his whereabouts?

More Covent Garden Opera.

OPERA is an acquired taste, and apparently listeners are getting to like it. Encouraged by the demand, the B.B.C. is putting on two more Covent Garden broadcasts shortly, viz., "The

(Continued on next page.)

NOTES AND NEWS.

(Continued from previous page.)

Jewels of the Madonna," and "Manon." Act II. of the former is announced for June 18th, and Act II. (Scene III.) of "Manon" will follow ten days later.

Character and Crystal Sets.

ALTHOUGH the strike clouds have happily cleared away, and the general stoppage seems quite remote history, the Continental papers cannot get over the way we weathered the storm. I notice that in the general chorus of praise, Britain's calmness is attributed chiefly to the national aplomb, but partly to radio. Onlookers are supposed to see most of the game, and in this instance I think they are quite right. The fact that Britain is the best radio-equipped country in the world has stood us in good stead, and we ought not to forget the fact.

Objecting to the Loud Speaker.

TALKING of the strike reminds me that I saw in one of the trade papers the other day, a report that at Plymouth there was a bit of trouble over the broadcast bulletins. Apparently a section of a listening crowd objected to the broadcasting of Government bulletins, and they actually became threatening outside one shop. By the advice of the police, the dealer in question discontinued the demonstration. I think this must have been an exceptional case, for I saw nothing of the kind in the London area.

The Surrey Songster.

ONCE again this year the B.B.C. scored a complete success in sending out the song of the nightingale, and a more beautiful item it is impossible to imagine. Down in the Surrey woods, at Miss Beatrice Harrison's home at Foyle Riding, near Oxted, the engineers sometime wondered if the coy songster was worth all the waiting. Three microphones and a lot of patience were employed, in glades favoured by the songsters, but the result justified all the trouble. Congratulations to all concerned.

The Zug Valve.

SCHWEIZ GLUHLAMPENFABRIK, A.G., of Zug, and Karl Burk, of Basel, Switzerland, have combined together to produce one of the funniest-looking valves the heart could desire. The anode is a disc with a hole in the middle, for all the world like a penny with a big central puncture. Through this hole goes a straight filament and a dumb-bell-shaped grid! Apparently the whole contraption puts the wind up the electrons all right, for the valve is claimed to be very efficient.

Wireless Controlled Bomb.

THEY say that an American scientist has perfected a wireless-controlled bomb. It travels 50 or 60 miles to a spot previously chosen, and then comes down and "creates," after which, presumably, the inventor whistles it off, and it goes back home. And so to bed.

If this is all that the Americans can do for "Brighter Radio," I don't think much of their contribution towards enlivening the ether, do you?

The Ether-Busters.

ACCORDING to "Radio Digest," they have cheerful programmes at the American station WAFD. This is how that journal expresses it:

"Yes, sir, WAFD certainly does warm up the atmosphere. Take those fire-blazin' Ether Busters that put on an air-ropin' rodeo every Saturday at midnight, Smitty leadin' the bunch of tootlin' cayuses burnin' up the electrons like streaks o' blue lightning'.

"You don't mind the weather so much when you come in from beddin' down the stock, your nose and finger-tips tinglin' from the cold. You drop a coupla hunks o' hard maple in the old Detroit heater, tune in WAFD, sit in the rocker with your feet on the stove-rail, and listen. Whoo-oo-pee! That's Smitty lettin' the bars down for the Ether Busters."

Sounds lively, doesn't it?

Experimenter Speaks to Spitzbergen.

AN Ulster experimenter, Mr. Frank R. Neil, recently succeeded in getting into radio touch with KEGK, the exploration ship "Chantier." This is the vessel that is carrying the Byrd Arctic

SHORT WAVES.

"The most wildly exciting of all modern inventions is 'wireless.'"—Lena Ashwell, O.B.E.

"I am a devoted listener-in, and every evening I switch on my set to hear the broadcast. Just as I am beginning to enjoy it we are switched on to some barbaric orchestra and I have to listen to shrieks and yells from an indeterminate number of barbaric instruments."—Lord Anslow, interviewed by the "Manchester Evening News."

"By the aid of the telephone circuits already constructed between England and the Continent it may be found possible later to connect anyone in Western Europe to anyone in North America through Rugby."—Dr. W. H. Eccles.

"It is to be hoped that all those newcomers who have found radio such a boon during the strike crisis will not forget to show their gratitude by joining the ranks of licensed enthusiasts."—Evening Standard.

Expedition, and at the time she was lying in King's Bay, Spitzbergen. News of Amundsen's Expedition was eagerly received by the other Arctic explorers, who stated that the "Chantier" was leaving for London in a few days.

2 L O-Quacious!

WHAT a hornet's nest the B.B.C. stirred up with those "Editorials"! For one thing, the word "Editorial" was unfortunate, I think, being pretty certain to arouse suspicion amongst those responsible for printed editorials. And then the treatment of the topics seemed a trifle like Grandma's lectures to naughty boys and girls, didn't it?

Of all the Press comments I think the "Evening News" took the Huntley and Palmer, with a reproachful headline which packed volumes into the simple statement, "2 L O-QUACIOUS!"

Ruling the Broadcast Waves.

INCIDENTALLY it was stated under that heading that the Postmaster-General said, "I have not seen the Editorials referred to, but I have asked for copies of them, and I shall then judge

whether they infringe the rule against broadcasting matters of political controversy."

Considering the extent and importance of the broadcast editorials, it seems a trifle casual and P.O.-like, doesn't it?

The Intrusive Pips.

"IS the B.B.C. getting careless?" asks an indignant reader, who hates to hear the Six Pips from Greenwich butting in to concerts or other items. He grumbles and grouses because at one time this never happened, and he fancies that they have become casual at headquarters, and don't take the care with the timing of programmes that was taken a few months ago.

There is no need to despair because the time signal now obtrudes itself, sometimes. It is impossible to time to seconds through a long concert, and the authorities think that most listeners would prefer the time-signal to be super-imposed upon the programme, rather than interrupt or hurry a good item for it.

Madame Melba Broadcasts Again.

SIX years ago, in June 1920, Madame Melba delighted radio enthusiasts by broadcasting from the old Chelmsford station. It was the first time that all Europe had been able to listen-in to a world-famous voice, and though that novelty has now worn off, the great singer is again assured of a vast and appreciative audience on June 8th. She is making her final public appearance in opera on that day, in "La Boheme," at Covent Garden, and excerpts from the performance will be relayed by the B.B.C.

PCGG Again.

OUR old friend PCGG, the Dutch wireless station at the Hague, is going to have another flutter upon Europe's ether. This was the good old station that was commissioned by The "Daily Mail" to provide Britain with broadcasting from the Continent, prior to the foundation of the B.B.C. It served its turn valiantly and well, and thousands of old-time listeners will be glad to hear this pioneer broadcaster upon the air again.

According to present arrangements, PCGG will take turns with the Hilversum station. The wave-length will be 1,150 metres, and attempts will be made to reach the Dutch East Indies upon 130 metres.

A Radio Hoax.

HEARD about the great American radio mystery? A bewitched telephone line running beside the railroad, near Reading-Pa., seemed to have the power of picking up broadcasting, and often when a signaller called up his next-in-line he would be astonished to hear some joyful jazz going on. Radio experts gathered and watched, all without avail, until somebody had his suspicions of one of the railroad telegraph operators, and had him suspended from duty. Then the truth came out. It was a hoax, caused by connecting up a broadcast receiver to the line. So now the signaller will have to buy a set if they want to hear the programmes, and incidentally, the other fellow is looking for a job!

ARIEL.



A Simple Explanation of the Propagation of Electro-Magnetic Waves.

By
Dr. J. H. T. ROBERTS,
F.Inst.P.
(Staff Consultant).

THE picture accompanying this article is intended to represent in a general way the initiation of electro-magnetic waves from the huge aerial of the new Rugby super-power transmitting station.

It will be understood, as, indeed, it is admitted by the artist who drew it, that a

the Hertz oscillator when no current is passing, the lines of electric force being indicated in the usual way. In Fig. 1 C the conditions are represented when current is actually flowing, and it will be seen that circular lines of magnetic force surround the oscillator.

In Fig. 1 D an attempt is made to represent the average condition when an oscillatory discharge is taking place. In this figure the lines of electric force and the lines of magnetic force are represented simultaneously, but it will be understood that these alternate, the lines of electric force holding the field when no current is passing and the lines of magnetic force when the current is flowing. In practice, of course, except at certain instants, the state of affairs is intermediate between these two, the energy being partly electric and partly magnetic. A very simple analogy which will enable

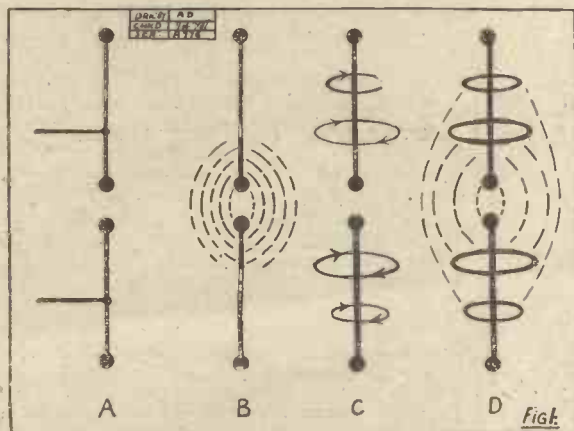
career its energy is partly kinetic and partly potential.

It was soon found that the simple Hertz type of oscillator was not efficient as a radiator of electro-magnetic energy, and the history of wireless development has been closely bound up with that of the development of efficient systems for electro-magnetic radiation—in other words, with the development of the “aerial.”

Radiation From Present-Day Aerials.

The present-day type of aerial is, in effect, a condenser in which one plate is a vertical or horizontal or suchlike conducting wire and the other plate the earth. By suitable means, electrical oscillations are set up between the aerial and the earth, so that electricity flows first into the aerial from the earth and then into the earth from the aerial, and so on. When the aerial is electrically charged there is created between it and surrounding earth an electrostatic field, which represents a state of strain, and an electric pulse travels out from the other in consequence, just as a movement travels through a jelly if it is struck at one part.

When the electricity is in flow between the aerial and earth, a magnetic field is set up, and again a magnetic pulse travels out through the ether. The two are not independent, however, as we have briefly explained above, but are definitely correlated, and the result is that from the aerial, or, to be more accurate, from the space between the aerial and the earth, there



picture of this kind can only give a very general notion of the manner in which the waves spring up from the aerial and proceed on their journey through space, and, of course, the drawing must not be taken too literally as regards its details—for one thing, the successive wave-fronts may be as much as 18,000 metres apart. Nevertheless, the picture gives a very good idea of the layout of the aerial, with its twelve 820-foot steel masts and its 800 miles of underground wiring which forms the earth.

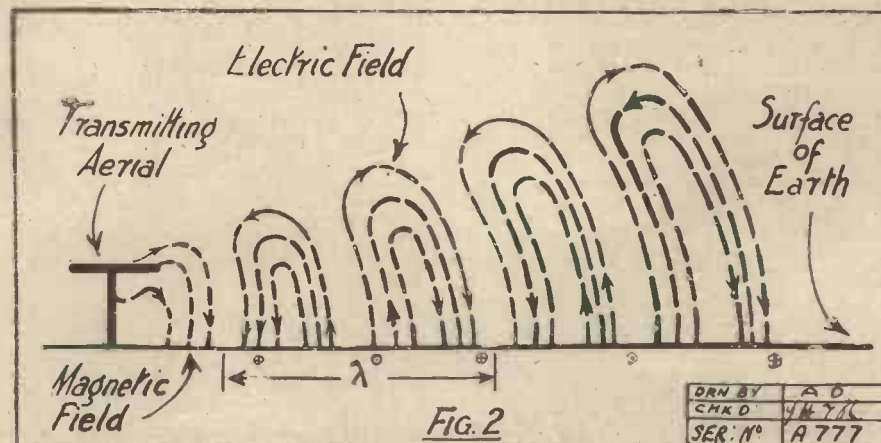
The First Hertz Aerial.

What remarkable strides are represented by an aerial such as this when compared with the original oscillator used by Hertz in his original experiments! It is interesting to recall that the first Hertz aerial consisted of two short wires, each with a metal ball mounted at the end, these wires being connected to a spark coil or static machine. As every reader knows, the oscillations were set up owing to the fact that when the potential difference between the two wires reached a sufficiently high value the insulation of the air in the gap broke down and a spark passed, the electricity on one wire jumping across to the other, there storing itself up for a moment, then returning, jumping back across the spark gap, and storing itself up on the first wire, and so on.

This phenomenon is known as an oscillatory electric discharge. In Fig. 1 is shown

this to be understood is that of the vibrating pendulum. When the pendulum is at the extreme end of its swing, its energy is entirely potential energy.

When the pendulum is at the lowest point of its swing, its energy is entirely kinetic energy. In practice, as the pendulum is oscillating its energy is continually being translated from the entirely kinetic



form to the entirely potential form, but it is only wholly one or the other at certain definite points of its swing and at certain instants, and for the greater part of its

springs a composition of the electric and magnetic disturbances, the whole of the radiation being known as a system of
(Continued on next page.)

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CREATING RADIO WAVES.

(Continued from previous page.)

electro-magnetic waves. How these waves travel through space, and how they may affect any other conducting body upon which they fall—in particular a “receiving aerial,” as it is called—is a matter of common knowledge to the readers of this journal, and there is no necessity to dwell further upon it.

Some Interesting Observations.

In Fig. 2 is indicated, roughly, the way in which the waves proceed from a transmitting aerial. It will be noted that the Rugby station transmits on a very long wave-length, and is therefore in a class entirely different from that of the short-wave amateur stations which are now so rapidly becoming popular in various parts of the world. The two represent, in fact, the extremes of wave-length in wireless transmission.

Some very remarkable and important discoveries have lately been made in

connection with the behaviour of short electro-magnetic waves during the course of transmission, and it is interesting to refer to these in connection or in comparison with the very long waves, such as those generated by the station depicted in the accompanying illustration.

It will be seen from Fig. 2 that, owing to the effect of the surface of the earth and certain other conditions, the wave-front, after a certain distance has been covered, becomes “staggered,” and, furthermore, it has been found, notably by an American experimenter, Dr. G. W. Pickard, that the short waves, after travelling a certain distance, which in cases under observation were of the order of 20 to 30 miles, are to a large extent twisted around so as to be nearly horizontal. He found that when the short waves of 80, 40, and 20 metres were measured by means of a special antenna they appeared to arrive at the receiving station with the electric displacement in the horizontal plane.

Dr. Pickard carried out his experiments by the use of a wooden tower about 20 feet high with a small platform at the top, upon which he mounted the special antenna. This latter consisted of two stiff wires about

10 feet long, extending in opposite directions from the receiver, which was mounted in a special box at the centre; thus the receiver was in effect mounted at the centre of a 20-foot antenna. Moreover, the antenna could be rotated so as to be vertical, horizontal, or at any other angle.

By means of experiments of this kind, Dr. Pickard made a number of very interesting discoveries in connection with the “staggering” of short electro-magnetic waves, a full account of which will be found in the February number of “Q. S. T.”

A Wonderful Aerial System.

The experiments of Dr. Alexanderson on the polarisation of electro-magnetic waves also represent a most important recent development in connection with the production of special types of waves, and it is likely that considerable use will be made in the future of the phenomenon of polarisation in connection with wireless transmission.

The progress of radio science indicates that a very great deal of research may yet be carried out with profit in connection with different types of antenna and different modes of wave-production. The wonderful aerial at the Rugby station (or perhaps it would be more correct to call it an aerial system, as it is of enormous extent and comprises a number of aeri-als linked together), by which an almost incredible amount of energy is hurled into the ether, represents, for the moment, the last word in high-power transmitting aeri-als, but progress has been so rapid in this most important subject that it would be very unwise to assume that in five years' time the same result may not be accomplished by means of an aerial or equivalent system much less vast. The Rugby aerial is a most imposing structure: it is like a great Druids' Circle of modern science.



This picture illustrates the manner in which ether waves are caused to radiate from the great Rugby station aerial system.

RED LEAD.

THE writer recently heard of a peculiar failure of a receiving set which was finally tracked down to the use of a paint which had red lead as a constituent.

It appears that the cabinet containing the instrument had received two coats of the paint and had afterwards had a variable condenser mounted on it, there not being sufficient room on the panel. The set was a powerful one, and although it was anticipated that there would be some leakage owing to the component being mounted on wood, it was never expected that there would be little or no results, but such was the case.

After exhaustive tests it was eventually discovered that a tremendous leakage was taking place through the red lead, and on the cabinet being replaced, just for testing purposes, by one of plain wood, results were as good as anticipated.

The fact that leakage can occur through paint containing red lead should not be forgotten when loud-speaker or telephone extension leads are being run. On another occasion the writer was baffled for some time by a series of noises occurring in a friend's installation, which were ultimately proved to be the result of leakage between terminals mounted on a painted wooden skirting.



By E. J. W. STANLEY, M.A., B.Sc.

JUST as it is important to use only the best components in a set—such as variable condensers, crystal detectors, distortionless intervalve transformers, bi-duplex-wound anode resistances, headphones, and loud speakers—so is it important to take care of one's set and its accessories. This is particularly so now that the light evenings are on the ascent and signal strength on the descent.

The Aerial and Earth.

Aerial ropes should be renewed once a year, as winter weather always plays havoc with them. Aerial insulators should be washed at the same time. If the earth connection is soldered to a water-tap in the house, examine the joint only to see that it is not corroded and making bad contact. If an external earth is used, conc out the soil round the earth plate, or rod, and pour a can of water on to it in dry weather.

Whether a crystal or valve set is used, it is important to overhaul the earth switch periodically. This is best done by rubbing the switch-blade and the contacts with fine emery paper or cloth, care being taken to rub down the parts with a clean rag afterwards. The terminals and connecting wires should be treated in the same way. It is also a good plan to remove the milled terminal screws from the set and rub down the contact faces with emery, as well as the wires which they clamp. If one terminal is removed at a time, it obviates the possibility of connecting wires to the wrong terminals.

If a crystal set is used, the crystal should be washed periodically in petrol with a clean, stiff brush, and the end of the cat's-whisker should be held in a pair of tweezers and a very smooth file passed across the end which makes a contact to obtain a clean surface on the maximum area.

Cleaning Variable Condensers.

The headphones—even the best—require periodical attention, just as the clock or watch, which lasts for years if oiled and cleaned once a year. However, in the case

of headphones, it means electrical and magnetic cleaning and oiling, and this should not be attempted at home. It is far better, and cheaper, to let this be done by experts in tuning, repairing, and re-magnetising. They carry out the work well and expeditiously.

Valve-set users should carefully dust the plates of their variable condensers, even if they are enclosed in a cabinet. This is best done with a flat $\frac{1}{2}$ -in. paint-brush with, say, 1 $\frac{1}{2}$ -in. bristles. A brush is better than a rag, as it avoids the danger of bending the plates out of shape. The panel should also be carefully dusted periodically on both sides, and the soldered connections tried to make sure that none of these joints are giving way. A corroded joint is often the cause of poor signals. Coil holders and plug-in coils should be examined to make sure that they make good contact.

Change-over switches should be cleaned in exactly the same manner as earthing switches. If quadrant type change-over switches are employed, it is best to remove the moving quadrant and to clean this with fine emery. The contact arms will have to be get-at-able, and these can be cleaned in the same way, care again being taken to wipe all contacts with a clean rag afterwards.

If a resistance-

coupled set is employed, it is well to have the anode resistance tested periodically. There are many inferior resistances on the market which alter in resistance with time, and therefore the signal strength diminishes. If, on test, these resistances are not what they are labelled, it will pay to scrap them and to buy permanent bi-duplex resistances, such as the Varley. These resistances are unaffected by weather changes or age, and are supplied in all values from 500 ohms to 250,000 ohms.

The Loud Speaker.

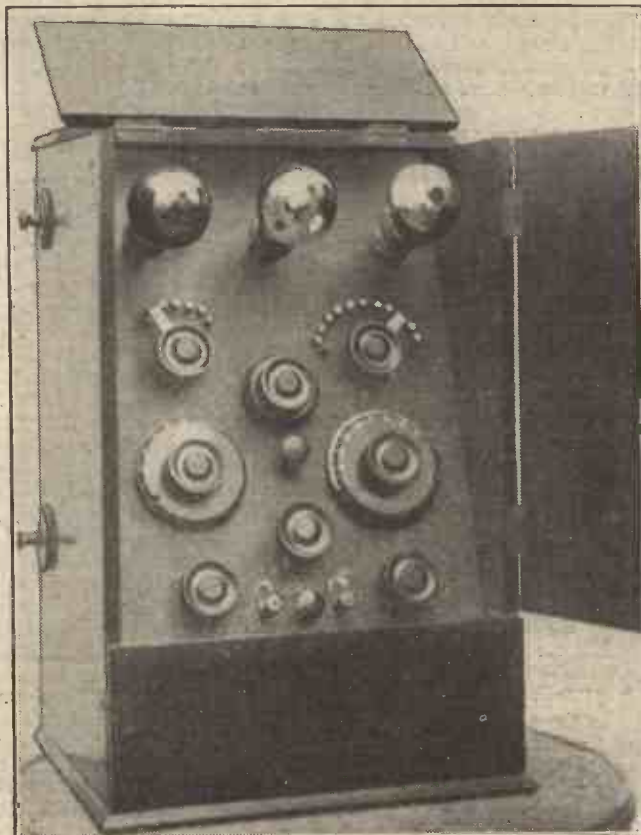
The loud speaker also requires periodical attention. Dust and grit get down the horn on to the diaphragm, and often the magnets weaken with time. The loud speaker is a delicate piece of apparatus on which so much depends, and it is best not to tinker with it. It will be found far more economical to send it to experts, who will bring it up to concert pitch for a few shillings. It is, of course, not necessary to send them the horn.

Low-tension batteries should occasionally be washed out with water and refilled with new acid of the correct specific gravity. If high-tension accumulators be employed, they should be given a charge not exceeding 60 milliamps once a month.

Avoiding H.T. Leakage.

When the set is not being used, the high-tension connection should be removed, as, if there is a slight leak on the set, it will not only help to run down your high-tension battery, but it may also damage your low-frequency intervalve transformer.

If the foregoing points are periodically attended to, the liability of the set breaking down will be considerably diminished.



An imposing three-valver, made by Mr. F. W. Phillips, of 41, Marine Avenue, Hove.

BROADCAST NOTES.

"Eights Week" Experiments—"Spoon-Fed" Entertainment—The State of Emergency—Selecting the New Commissioners—A Canadian Programme—The Echo-Rooms.

By O. H. M.

I HEAR there is a strong probability of the great pianist Lamond being included in the B.B.C. programmes in August. He is now engaged in an American tour, but he has already expressed a desire to play again for British listeners as soon as possible. Lamond's previous broadcasts firmly established him in the esteem of millions of listeners, and his next engagement at Savoy Hill will be anticipated eagerly. That it should be in August is a sign that the B.B.C. will this year refuse to recognise anything in the nature of an "off-season" for serious broadcasting. Given such a policy at Savoy Hill, there is no reason why interest in wireless should not remain high throughout the summer.

"Eights Week" Experiments.

Experiments are being made with a view to broadcasting some of the characteristic noises during a critical moment of the Oxford "Eights Week" this summer. I think this will provide much better material for a successful "atmosphere" broadcast than would the Derby. The reason is, of course, that people are so keenly interested in the result of the Derby that if they cannot have a running commentary with the noises they are apt to be profoundly dissatisfied. On the other hand, the actual results of the Eights Week races at Oxford are of keen interest to only a small proportion of people. It is the "atmosphere" that counts in a broadcast of this kind, and that is why, given its existing limitations, the B.B.C. should concentrate more on "atmosphere" occasions.

It is generally understood that the reason for the postponement of the Birthday Honours until July is to enable the Government to include a special list of those deserving of recognition for their work for the nation during the Emergency. Certainly no organisation did more than the B.B.C. for the country, and recognition of this in the Honours would be a very popular act. But I gather that there is some anxiety on the subject at Savoy Hill. The people there are quite rightly anxious to keep absolutely clear of the suspicion that they were in any sense partisan during the Emergency. On the other hand, it is interesting to note in the official organ of the B.B.C., that on the constitutional issue they were definitely on the side of the Government. I do not see how they could have been otherwise. Therefore, to the extent in which their efforts helped to preserve the authority of the Constitution they are certainly deserving of generous public recognition.

"Spoon-Fed" Entertainment.

In the course of conversation with some of the B.B.C. programme officials the other day, I was told of an interesting controversy now going on in their inner councils. This relates to the degree in which listeners should be "spoon-fed." One group holds

that the art of broadcasting is still so undeveloped that constant spoon-feeding is necessary; they add that the average listener must be called upon for the absolute minimum of effort in following a programme. The other group maintains that the time has come when artistic effect should no longer be sacrificed for the purpose of making things over-easy for listeners. The particular problem of the moment is in connection with the presentation of serial drama. Should it be assumed that listeners will follow each part, or should each episode be so arranged that listeners will be given a self-contained effect? The spoon-feeders have had their way up to the present, but the other side has now gained the ascendancy, and we are to have some experiments in deliberately testing how much trouble listeners will take. My own view is that the



A new penny in the slot wireless set that is being installed all over America.

experiments will fail. The whole tendency of the age is to minimise exertion in entertainment. Most listeners would prefer to have the stuff "easy," even at an artistic discount.

The B.B.C. "Editorials."

As I prophesied last week, the B.B.C. is endeavouring to retain some of the features developed during the Emergency. This applies particularly to the "Editorials," which take the place of the "Appreciations" of the Strike period. To my mind it is only right that the B.B.C. should endeavour to give the country a lead on pressing problems. Of course, it means entering the field of controversy, hitherto banned by the Post Office interpretation of the licence. The other day, I tried to get a reaction to this development from a Post Office official. He was characteristically cautious, and made a point of disclaiming

all responsibility for the Editorials broadcast during and since the Emergency. It seems that the Emergency is still "on," and that until Parliament calls it off formally, the B.B.C. has much greater freedom of action than under normal conditions. All I can say is that so far as broadcasting is concerned, I wish Parliament could arrange for a perpetual state of Emergency. I know it is argued that all will be put right with the new constitution of broadcasting next year, but it would be the height of folly to allow red tape to fritter away the wonderful prestige gained by the B.B.C. during the Emergency. And it is quite certain that something like this will happen if officialdom gets a renewed hold on the service for the rest of this year.

The Broadcasting Commission

Mention of the future constitution of broadcasting reminds me that one important result of the Strike has been the creation of a general feeling that the B.B.C. should not be tampered with in any way, and should be given a clear ten years' period in which to continue its great work. There will be more heard about this in Parliament. While I imagine the Government has gone too far to recede from the policy of a Commission, I believe they will have to recognise the strength of this feeling when they come to the selection of the Commissioners. Before the Strike, it was generally believed that Mr. Reith would be Executive Commissioner and ex-officio Vice-Chairman of the Commission. Now it would seem probable that Mr. Reith will be made Chairman, and that someone else will be made Executive Commissioner.

A Canadian Programme.

The B.B.C. is making special plans for July 1st, when a Canadian programme will be given in honour of Canada's Dominion Day. This will be the first of a new series. The special day of each of the Dominions will be similarly celebrated. If I could make one suggestion, it would be that for each of these special shows the B.B.C. should use as the announcer a member of its staff belonging to the Dominion concerned. I understand that all the Dominions are represented on the B.B.C. staff. If this were done, it would create an excellent effect throughout the Dominions concerned, and would lead to valuable publicity for the B.B.C. overseas.

The Echo-Rooms.

Quite the most extraordinary recent development technically at Savoy Hill is the remarkable success of the new echo-rooms. As the result of experiments just finished, I understand that it is now possible to give almost any kind of echo and resonance to particular programmes. A parallel microphone in the echo-room, modulated and controlled in conjunction with the studio microphones, has solved some of the most serious problems in the way of the adequate reproduction of classical music.

READERS' QUERIES.

"Popular Wireless" offers its readers the best Technical Queries Service in the country. Turn to the Radiatorial page for full details, and don't fail to take advantage of the advice of experts if you are in trouble with your receiver.



FOR a time the great popularity of reflex circuits, which employ a crystal detector and two valves, has overshadowed the merits of the corresponding straight circuit; but recently there has been a strong tendency amongst the two-valve-and-crystal owners to return to the

By means of a single-pole double-throw switch the last valve can be placed in or out of circuit as desired, the second valve's filament current in the latter instance being turned off by the second rheostat.

Easy to Construct.

When worked in this way as a "straight H.F. and crystal detector," the set is a very economical long-distance receiver. With an average aerial it should tune in anything from half a dozen to about a dozen stations, provided the local station is not too near to permit of distant reception.

When the desired station has been tuned in, the last valve—which acts as a straight L.F. amplifier—can be used to strengthen up the signals.

Unlike most reflex sets, both the construction and the operation are straightforward, and the set is generally successful straight away, even in the hands of an inexperienced constructor. The knack of tuning is soon gained, crystal detector is used;

straight circuit, and its merits are once again winning it a place as a favourite.

Such a circuit will receive equally well upon the shorter or longer waves used for broadcasting. It will pick up 5 X X at good strength in any part of the country, and it is quite a common feat for a well-operated set to receive ten or a dozen other stations as well.

Good Long-Distance Set.

It is, moreover, a cheaper circuit to build than the two-valve-and-crystal reflex, as it entails the use of only one L.F. transformer, instead of two. The resultant volume is necessarily reduced, and except at short distances the receiver will not work a large loud speaker; but it is an excellent set for loud headphone results at long distances, and will work two, three, or four pairs quite easily.

especially if a good with an adjustment that seldom requires handling when once the sensitive spot has been found.

Other points about the circuit can be seen from the theoretical circuit reproduced on this page. The aerial tuning condenser can be placed either in series or in parallel with the aerial tuning coil, so that suitable plug-in coils will enable the receiver to tune over a very wide band of wave-lengths.

The Set designed, built and described by the "P.W." Technical Staff.

For the shorter waves, series tuning generally gives better results, and this requires a 75-turn coil for the A.T.I. To place the condenser in series, the aerial lead should be connected to the terminal marked "Series," and the terminal marked "Parallel" is left without an external connection. For the higher wave-lengths the condenser should be placed in the parallel position in conjunction with the appropriate aerial coil (35 or 50 for main and relay stations, 150 or 200 for 5 X X.)

Parallel tuning requires the aerial lead to be placed on the "Parallel" terminal. In this instance the "Series" terminal is joined to the

LIST OF COMPONENTS.

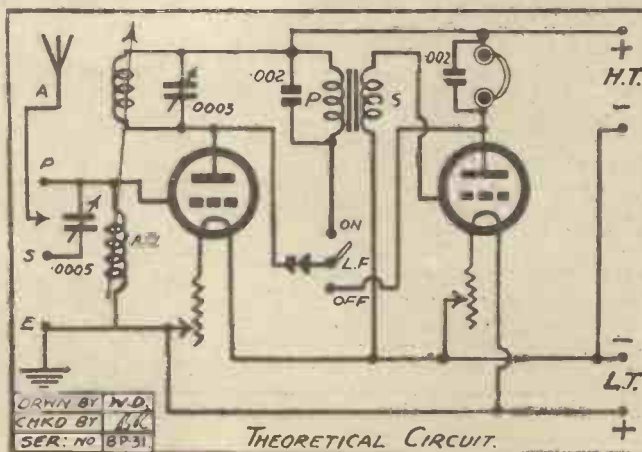
	s.	d.
1 Panel, 12 x 10 x $\frac{1}{8}$ in. (Peto-Scott)	7	6
1 Box to fit, $4\frac{1}{2}$ in. deep (Peto-Scott)	10	0
1 1st stage L.F. transformer ("Gol-tone")	17	6
1 Two-way coil holder ("Lotus")	7	0
2 Valve holders (Peto-Scott)	1	0
2 Filament resistances	6	0
1 .0005 variable condenser (Lam-plugh)	12	0
1 .0003 variable condenser (Wates' "K")	7	9
2 .002 fixed condensers (Clarke's "Atlas")	4	6
1 Crystal detector ("Lion")	3	6
9 Terminals	1	1 $\frac{1}{2}$
1 S.P.D.T. switch	1	6
Wire, transfers, screws, etc.	1	0

ACCESSORIES.

- 1 H.F. valve
- 1 L.F. valve
- H.T. and L.T., to valve makers' specifications
- 1 pair of 'phones
- Two or more tuning coils, according to wave-lengths desired.

"Earth" terminal by a short strip or wire. (For both positions the earth-lead is connected to the "Earth" terminal.)

(Continued on next page.)



THE "PROVINCIAL" TWO.

(Continued from previous page.)

Reaction effects are obtained by coupling the aerial and tuned anode coils in a two-way coil holder. Either bright or dull-emitter valves can be used with H.T. and L.T. batteries in accordance with the specifications of the valve maker. (The correct voltages, etc., are generally stated clearly upon the box in which the valve is purchased.)

The Parts in Use.

The list of components used in the set shown in the photographs is given on page 509. All these are of standard size, so that similar components of different make can be used instead, if desired, without the necessity of modifying the size of panel and case.

Construction is commenced by preparing the panel. The position for the various components is shown by the photographs and back-of-panel diagram, and by the dimensions on the drilling lay-out.

The terminals should be mounted first, and filled ready for soldering. Then the S.P.D.T. switch, valve holders, and crystal-detector should be mounted and prepared. Finally, the rheostats, transformer and variable condensers may be placed in position, as shown in the back-of-panel diagram.

Simplifying Construction.

There is no need for the fixed condensers that are placed across the 'phone terminals, and across the primary of the L.F. transformer, to be attached directly to the panel. Instead of utilising separate fixing screws for these small components, they may be supported quite adequately by their own wiring.

This obviates the necessity for making special holes in the panel for the fixing-screws, so most constructors will prefer the condensers to be self-supporting.

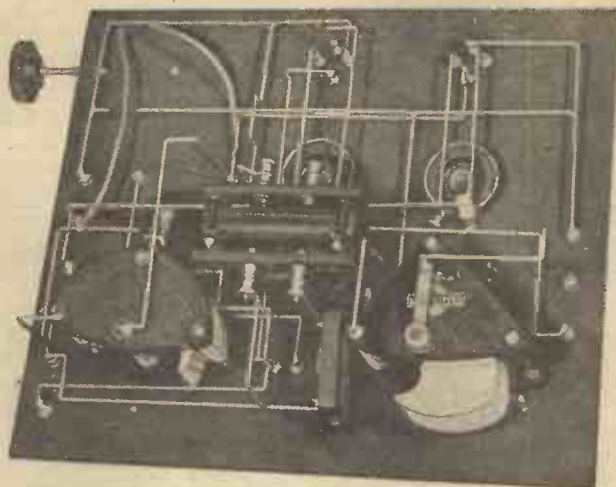
The Wiring.

The wiring is carried out with any suitable stout wire, of about gauge 16. In the actual model constructed in the "P.W." laboratory, and shown in the photographs, square-section tinned copper wire was used, but if preferred, glazite, or similar covered wire could be used instead.

For the benefit of those readers who have not previously tried to construct a wireless set from blue print or wiring diagram, it may be necessary to emphasise the fact that a certain latitude is permissible in the choice of components. For instance, although the rheostats shown in the photograph and on the blue print are of the wire-wound type, it is not essential to employ this class of filament resistance. If desired, the more compact form which relies for its operation upon the compression of carbon pellets may be utilised, and as these components are generally quite small and compact there will be ample room for them upon the panel.

Concerning the L.F. Transformer.

Similarly, one of the "hedgehog" type low-frequency transformers can be employed instead of the type indicated in the photographs. It is, however, important to use a transformer which has been designed for "first stage" work. Generally the ratio of such a transformer is between 3 and 5



How the parts are arranged under the panel is clearly shown by this photograph

to 1, and the function it has to perform is different from that of a second-stage low-frequency transformer in which the ratio of the windings is equal (i.e. one to one).

From the foregoing it follows that slight variations in the components themselves do not affect the action of the receiver, provided they are of suitable design for the work they have to perform. Such variations as a vernier adjustment on one or both of the variable tuned condensers can be left to the discretion of the constructor.

Generally speaking it is decidedly advantageous to employ a vernier control, especially on the anode condenser. Owing to the fact that this circuit is coupled to the aerial for purposes of reaction, correct adjustment of the anode tuning is particularly effective when trying for distant stations. So if only one vernier can be employed, the anode condenser should preferably be fitted in this way; but if both condensers can embody vernier adjustment so much the better.

Testing the Set.

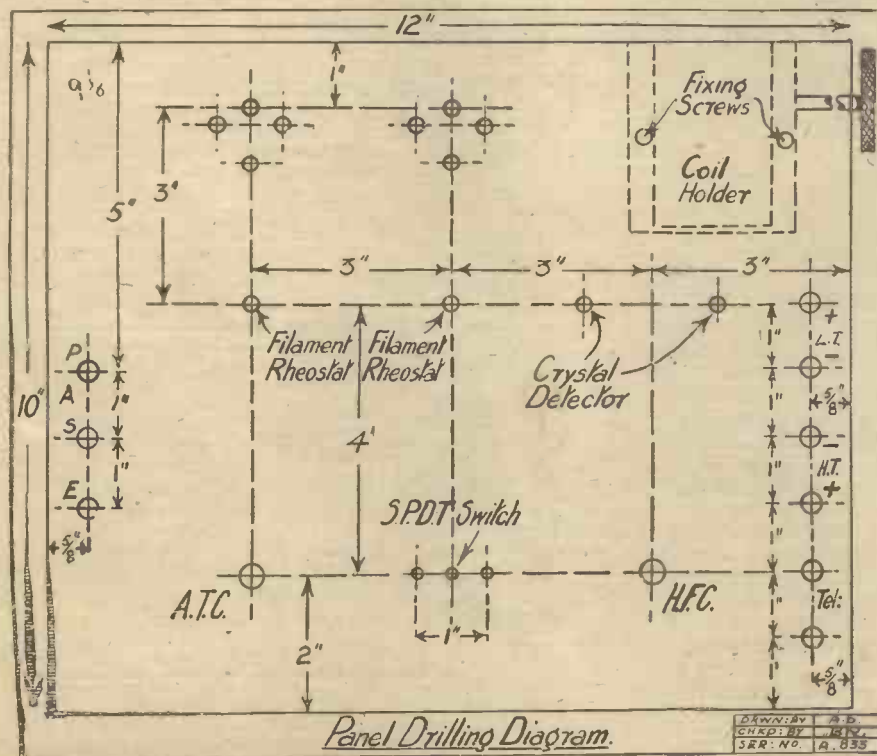
The valve holder shown in the photograph is of the countersunk type, but if those of the solid block type are already on hand, or are preferred, they can be used instead.

There is no need to describe the wiring in detail, as this is shown by the wiring diagram on this page. It is interesting to note that this diagram is a small-scale reproduction of part of the "P.W." Blue Print, Number 16. The "Provincial Two" is one of the popular sets made up direct from this blue print, so readers can, if desired, obtain the blue print from the Query Department for 6d. (See the announcements under "Radiatorial.")

Correct Components.

It will be found that, in addition to the enlarged wiring and theoretical diagrams, the circuit is given in pictorial form upon the blue print. This being the case, the most inexperienced constructor need not fear to tackle the making of the set with the aid of these instructions and photographs and "P.W." Blue Print, Number 16.

Like all sets in which H.F. amplification is employed, great care must be taken, when soldering, that no flux is left adhering to the wiring. Unless it is wiped off at the proper time it is extremely difficult to



(Continued on next page.)

THE "PROVINCIAL"
TWO.

(Continued from previous page.)

remove from the wires or panel, and the efficiency of the set is greatly impaired.

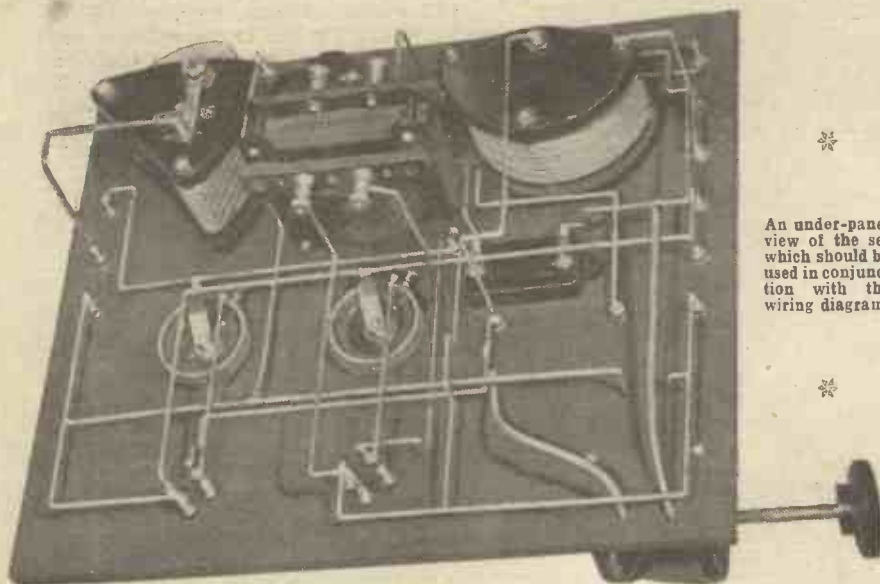
Trouble from this source can be avoided completely if the constructor remembers to keep a clean duster in use when soldering. As soon as the soldered joint has "set,"

a clean job of the wiring. Once the habit of wiping over the hot joint is acquired, the back of the panel can be kept perfectly clean without any trouble.

When the wiring is completed the connections should be checked over from the point-to-point list on this page.

Indoor Aerial.

The set is intended for use on an outdoor aerial, but quite good results are obtainable upon an indoor aerial, placed in the roof



and whilst it is still hot, it should be wiped over with the duster. The flux, completely liquified by the heat, is then easily removed, but if the joint is left until cooling starts it grows more and more difficult to make

or under the ceiling. Over very limited distances a frame aerial can be used, but this is not recommended.

To test out the set upon the short waves, connect the aerial lead to the series

terminal, and the earth lead to the earth terminal. Join the L.T. battery to its respective terminals and connect up H.T. negative. Insert two 75-turn coils into the coil holder.

Throw the L.F. switch into the one-valve position and turn on the first rheostat until the filament voltage is approximately correct (see valve-makers' instructions). Now plug in the H.T. plus plug to a fairly low voltage on the H.T. battery, when a distinct "plonk" will be heard in the 'phones.

At first keep the coils well apart, so that reaction effect is at a minimum, and vary the two condensers simultaneously. Adjust the crystal detector, and when weak signals are

POINT-TO-POINT CONNECTIONS OF THE "P.W." "PROVINCIAL" TWO.

Aerial parallel terminal to grid socket of first valve holder, fixed plates of .0005 variable condenser and socket of fixed coil holder.

Aerial series terminal to moving plates of .0005 variable condenser, earth terminal to plug of fixed coil holder and to L.T. positive. L.T. positive is also connected to one side of the first rheostat, and to one filament socket of the second valve holder.

L.T. negative is connected to H.T. negative, to one side of the second rheostat and to one filament socket of the first valve holder. The remaining connection of each rheostat is taken to the remaining filament socket of the corresponding valve holder.

Plate socket of first valve holder to one side of crystal detector, socket of moving coil holder and to moving plates of .0003 variable condenser.

Other side of crystal detector to centre contact of S.P.D.T. switch, fixed plates of .0003 variable condenser and plug of moving coil holder to I.P. of L.F. transformer and H.T. positive. O.P. of L.F. transformer to right-hand contact of S.P.D.T. switch, I.S. to grid socket of second valve holder, O.S. to L.T. negative lead

Plate socket of second valve holder to left-hand contact of S.P.D.T. switch and bottom 'phone terminal, top 'phone terminal to H.T. positive.

A .002 fixed condenser is connected across the primary (O.P. and I.P.) terminals of the L.F. transformer, and another of similar capacity across the 'phone terminals.

received set the detector at its most sensitive position, after which this adjustment can be left alone. Now signals may be strengthened by increasing the coupling between the coils, varying the tuning condensers accordingly. The knack of handling is soon gained, and once it is mastered the set is a source of infinite pleasure to those interested in long-distance reception.

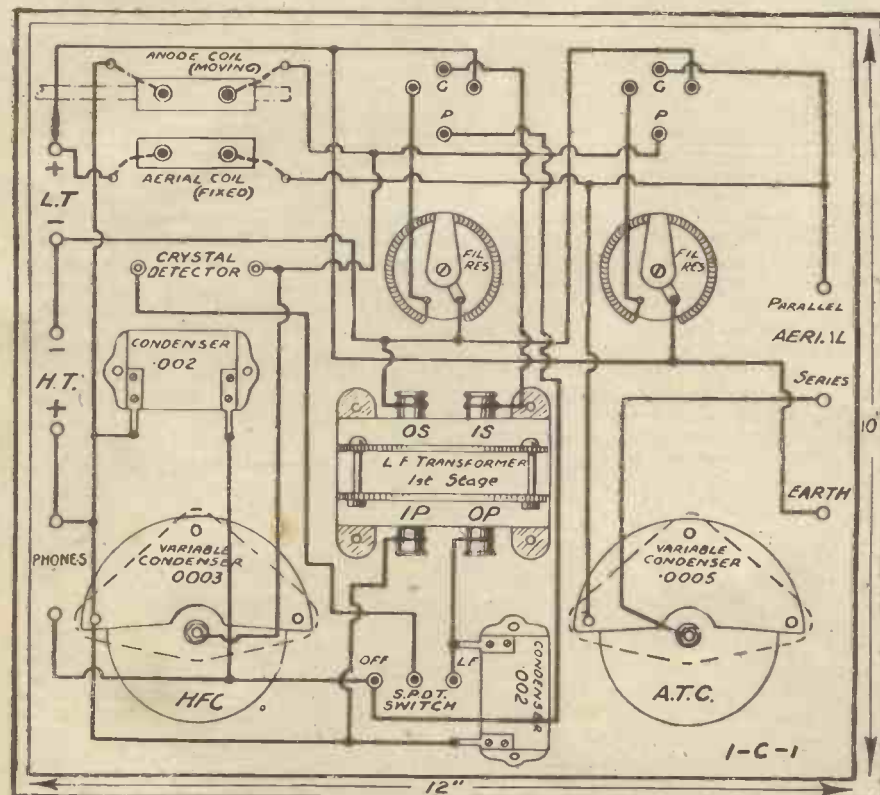
NEXT WEEK:

HOW TO MAKE A

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By A. W. HULBERT.

A FRIEND of the writer's who owns an accumulator charging station, and through whose hands hundreds of wireless accumulators pass every week, made the interesting statement that practically 60 per cent of these accumulators were neglected by their owners, and their life reduced in some cases by 50 per cent through ill usage.

In this article the writer will endeavour to describe the way to make the wireless accumulator last longer, hold its charge longer, and give better all-round service.

As the majority of readers are aware, the wireless accumulator consists of a number of pairs of lead plates immersed in dilute sulphuric acid, and usually mounted in celluloid or ebonite cases, with the sets of plates connected to two terminals on the top of the containing case.

By passing a current of electricity through the accumulator a rearrangement of the chemical components of the plates is made to take place and, on disconnecting the accumulator from the mains and wiring it up to an electric bulb or a wireless valve, it will be found that a current of electricity passes from the accumulator, causing the lamp or the valve filament to glow.

Concerning Capacity.

One of the causes of accumulators giving trouble is allowing them to run right down until they are absolutely exhausted. This is very bad for them, and as soon as they show signs of running down they should be taken to the charging station. The frequency with which recharging is necessary will depend upon two things—the size, or ampere-hour capacity of the accumulator, and the number of valves used on the set. Obviously, the more valves in operation, the more frequent will be the recharging.

With regard to the capacity of the accumulator, when two or more valves are used, this should never be less than 20 actual ampere hours. In a one- or two-valve set, a 4-volt 20 or 4-volt 30-ampere-hour accumulator will be suitable; but when three or more valves are in use, 6-volt accumulators of 40 to 60 ampere-hour capacity should be used, the voltage across the valves being cut down by means of the usual filament rheostat.

Quite a number of wireless "fans" fail to appreciate the fact that by cutting down the voltage slightly, not only will the life of the valve be prolonged, but the accumulator will last longer for one charge. The reproduction, either in the 'phones or

loud speaker, will be considerably clearer in most instances, and far less harsh than if the valve filaments were glowing at full brilliancy.

"Sulphating."

The greatest and most frequent trouble to which accumulators are prone is sulphating. Sulphate is caused by overcharging, by charging too rapidly, by discharging them at too high a rate, or by leaving them too long in a run-down condition. It consists of a hard white substance on the surface of the plates, and is really sulphate of lead. The presence of sulphate is most detrimental to the accumulator, as the act



Among the interesting exhibits at Marconi House can be seen some of the earlier types of variable condensers used by Senatore Marconi.

of scraping it off the plates invariably results in a certain amount of the active material being brought away from the plates at the same time, with a consequent loss of ampere-hour capacity.

It is a good plan to keep two accumulators in use and to put one on charge directly it shows signs of running down. Nothing ruins an accumulator quicker than leaving it in a discharged condition. Even if an accumulator is left standing idle, it should be given a freshening charge once a month to keep it in good condition.

Charging Batteries.

If the reader has no facilities for charging accumulators from the house mains he should use discretion in selecting a firm to do this work for him. Many firms are springing up in large towns, advertising that they will collect, recharge, and deliver wireless accumulators of any capacity the same day; this, of course, is absurd, because to do them properly and at the correct charging rate, at least two days are necessary.

The most reliable people are those who run large car battery service stations; they take care to see that all accumulators are properly charged at the correct rate, and will arrange to clean out and refill with acid whenever necessary. Never let an inexperienced man tinker with an accumulator; careless handling will do more to shorten its life than any amount of ordinary hard work.

Charging at Home.

If the reader is living in a district served with a direct current supply, it will be perfectly easy for him to charge his accumulators at home at practically no cost at all. In the present article, however, we are dealing with the actual treatment of the accumulator itself.

On the side of most accumulators will be found a printed slip, giving special instructions for charging, the specific gravity of the acid, etc. These instructions should be most carefully adhered to.

The terminals on top of the case should be kept clean and bright with emery paper, and covered with vaseline to prevent the acid fumes corroding them.

Refilling with Acid.

Acid should be added only if the electrolyte has been accidentally upset. If the level of the solution has sunk below the top of the plates, distilled water should be poured in until the tops of the plates are well covered with electrolyte. When acid is used for refilling an accumulator, it should be diluted in the proportion of one part sulphuric acid to four parts distilled water. In mixing, always pour acid into the water, never water on to the acid.

Hydrometer Test.

It is useless attempting to test as to whether an accumulator is fully charged by means of a voltmeter; the reading given on open circuit is entirely different

from when the cell is on discharge. The only reliable method is with the aid of an hydrometer. This consists of a glass tube fitted with a rubber teat.

Inside the glass tube, or body, is a small float marked with a scale and sometimes with the words "Fully charged," "Half charged," and "Battery exhausted." A reading is taken by inserting the end of the hydrometer into each filler vent in turn and squeezing the rubber teat. Then draw some of the acid up into the glass body of the hydrometer, and at the same time it will cause the small float to take up a position so that the reading is approximately 1.225.

Another sign that the accumulator is charged is when the acid in each cell assumes a milky appearance, the positive plates turning a rich brown colour and the negatives a slate grey.

On no account should an accumulator be short-circuited. Having practically no internal resistance, it will discharge itself almost immediately, in addition to which the plates will probably be badly buckled.



By THE EDITOR.

THOSE pessimists who have been cherishing the idea that broadcasting was only a craze will be interested to know that on May 1st the number of wireless licences issued was 2,012,000, according to the G.P.O. figures available. How many new licences were taken out as a direct result of the general strike cannot be gauged at the moment, but it is certain that many thousands extra can safely be added to the above figure. There is not the slightest doubt that the general strike created a boom in wireless hitherto unknown in this country.

Broadcasting has now definitely proved itself a national institution. Mr. Baldwin has given it his blessing, and Mr. Reith, as Managing Director of the B.B.C., has shown that in the right hands it can play an extraordinarily important part in the conduct of affairs in times of emergency.

"Only a Game."

But it is curious to note in the "Morning Post" a report that only just before the strike a distinguished politician observed, apropos of the broadcasting report: "Why bother about it; radio is only a game for children." That distinguished politician must be feeling rather foolish these days with the evidence of the importance of broadcasting so ably demonstrated during the general strike. And even though he made this remark before the general strike, if he did not feel foolish himself, other people must have thought how foolish he was, for broadcasting has revolutionised modern ideas of entertainment; it has brought beautiful music and an appreciation of other things beautiful into the homes of hundreds of thousands of British men, women and children, who, before the inauguration of the B.B.C., were deprived of such benefits.

Growth of Popularity.

It is a curious thing how people who pride themselves on being cultured and members of the *intelligentsia* adopt a snobbish and condescending attitude towards broadcasting. The explanation, no doubt, is that because a thing is popular it is not worthy of the serious consideration of "superior" serious people; but "superior" persons who adopt this attitude only betray their own narrowmindedness. Such people are really not worth criticising and their opinions on the subject are really of not much value.

The fact remains that broadcasting to-day stands higher in the esteem—and we might almost say in the affection—of the public than at any other time in its career; and however much the intellectual snob may deprecate it, how ever much the superior

person may pooh-pooh its influence, there can be no doubt that the Government have realised at last that in broadcasting there is a power for good or for evil of unprecedented strength; and a power which, if handled properly, can prove of the utmost benefit to the citizens of this country. 2,012,000 people have taken out broadcasting licences. That figure is an extraordinary indication of the growth of the popularity of broadcasting in this country and it is a figure which, during the next twelve months, will

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undoubtedly be increased until it reaches a total—no one can say how far in excess of 2,012,000.

During the strike 2 L O increased its power and it had been calculated that 2 per cent. more of crystal users were enabled to get in touch with 2 L O and receive the news.

Valve users did not benefit much by this increase in power owing to over modulation, but even with the increase of power it was noticed that certain areas well within the range of 2 L O failed to hear the signals.

Every listener who makes fairly consistent use of his set is familiar with the fact that for no apparent reason at all wireless waves often fade in strength. This variation in the intensity of signal strength takes place chiefly at sunset, and is particularly noticeable on the broadcasting wave bands at distances of from 50 to 200 miles from a station.

Cause of Fading.

According to "The Times," recent experimental research has shown that this fading is due to interference effects produced between two waves which arrive at the receiving station from the transmitter. One of these waves is transmitted straight along the earth's surface and is sometimes termed the direct wave. The other wave travels upwards from the transmitter to the higher regions of the earth's atmosphere until at a certain height it is deflected down again, ultimately arriving at the receiving station.

It is thought that in the day time this wave, which travels upwards to the higher atmosphere, is quickly absorbed in the atmosphere due to the influence of the sun-

light, and therefore only the direct or earth waves reach the receiver. This latter wave gives a fairly consistent signal strength during daylight hours, but with the setting of the sun the absorption of the indirect wave is considerably reduced, and owing to the fact that this wave has had to traverse a longer path than the direct wave, it eventually arrives at the receiver in such a way that it detracts from or enhances the effect of the direct wave upon the receiver depending on the actual path or route difference of the waves.

If the two waves arrive together, or in phase, they add together and produce a strong signal, but if, however, the waves arrive at different times—although the difference in time is minute—the out-of-phase effects are noticeable in the form of reduced signal strength.

Shielding Effects.

It is thought that as a result of the passage of the indirect wave through the upper atmosphere, a continual changing effect occurs in the receiver so that signals heard vary in intensity. This is a form of fading over which the amateur can exercise no control. Other forms of fading can sometimes be counteracted. For instance, an amateur who erects his set in a low-lying valley surrounded by trees, may find reception, if not impossible, at least very difficult, but he can better the location of his set.

We, in the office of "P.W.," Fleetway House, Farringdon Street, find that distant reception is almost impossible even when using the most powerful receiver. This is due undoubtedly to the masses of steel and ironwork in the building in which the "P.W." rest room is placed, and for that reason we decided to erect an experimental station at Dulwich, a fairly open suburb of London, some seven miles from our London office. Here, with a good 60 or 70 feet aerial and using a receiver of one or two valves, we can obtain results incomparably better than those obtainable even with a powerful super-heterodyne set in the test room at the "P.W." editorial offices.

Senatore Marconi's Set.

On the whole, it is rather extraordinary that amateurs in London should obtain such very good results with their receivers when it is borne in mind that the amount of steel and ironwork, telegraph and telephone wires, etc., in the metropolis is very great. It would be thought that the absorption in the heart of London would be so great as to render good reception from distant stations almost impossible.

In this case it is interesting to relate the story of a powerful set which Senatore Marconi uses in his suite of rooms in a famous hotel in London. He finds that even with an outside aerial distant reception is rendered very difficult owing to the amount of steel, etc. in the framework of the building, but luckily there is one clear space facing one of his windows which points exactly in the direction of Rome, and from Rome he can get excellent results. He can receive other signals from continental stations, of course, but when his frame aerial is rotated in the direction of Rome he gets his very best results because in that particular direction, straight through the window, there are no tall buildings or other obstructions which would create fading effects.

THE ETHER PROBLEM.

Latest Developments in a Great Controversy.

FROM A SPECIAL CORRESPONDENT.

THE scientific world is again in somewhat heated dispute over that most debatable and mysterious substance—the ether of space. Not, of course, that it has ever been in anything but dispute over the ether, but new impetus has been given to the argument by the statement of a well-known American scientist that he has discovered new facts about the ether—facts which tend to refute that portion of the Einstein theory which deals with this medium.

The Einstein Theory.

It will be remembered that Einstein, in his *The Theory of Relativity*, says that, in effect, the ether is non-existent and is not required in the scheme of the universe. Einstein based his theory largely on the failure of the famous Michelson-Morley

experiment. In this experiment Michelson and Morley endeavoured to find the velocity of the earth through the sea of ether, but failed to find any indication of such motion or any trace of the ether.

Wave Propagation Difficulties.

Thus the ether theory, of late years, has fallen somewhat into disrepute. In addition to this, about two years ago the late Dr. Steinmetz, basing his statements largely on Einstein's postulations, and on his own research into the matter, stated that light, wireless and other vibrations did not take place in the so-called ether, but in a magnetic field or flux, and that the ether was non-existent and the ether theory unnecessary.

Sir Oliver Lodge took up the cudgels on behalf of the ether theory, and pointed out

that the ether theory was only unnecessary to the Einstein theory, which fact did not make the ether non-existent. Regarding the Steinmetz theory of etherless wave propagation, Sir Oliver Lodge said that Steinmetz had only given the ether another name—that the substance in which Steinmetz had stated the waves took place was still the ether as they understood it.

Since the Einstein theory was put forward, however, the ether theory has gradually lost ground, especially in America, where scientists have shown that there is hardly a single factor pointing to the existence of the ether; and as far as wireless is concerned the Steinmetz theory has been largely accepted. The ether theory was advanced, they say, to explain the wave theory of light which now includes the wave theory of wireless energy.

For instance, if light or wireless energy be propagated in wave formation there must be some substance in which the waves can take place. Sea waves take place in their medium, the sea; sound waves in air, and so on. Obviously light waves could not take place in air, as light will shine through a vacuum—yet there must be some medium, and so this hypothetical substance was called the ether.

Furthermore, although the wave theory of light has been generally accepted for over a hundred years, there is now some doubt that light does travel in wave form, and the same applies to wireless radiations.

The wave theory was put forward principally to explain certain well-known phenomena in connection with light, such as interference. Interference, to explain briefly, occurs when two rays of light on being opposed to each other in a certain manner produce darkness by cancelling each other. The crest of one wave, as it were, fills up the trough of the other, and this can only be explained by a wave formation.

"Ether Drift" Proved.

On the other hand, recent discoveries seem to indicate that light and wireless may travel in the form of particles or small bundles of energy known as quanta, and eventually this quantum theory, as it is called, may upset the wave theory.

So it will be seen that the ether wave theory hangs on a very slender thread. This thread, however, is now considerably strengthened by the statements of Dr. Miller, President of the American Physical Society, who claims to have discovered what is known as an ether drift, which means that he has found a slight but concrete proof of the existence of the ether. He has discovered what Michelson and Morley set out, but failed to do, forty years ago, namely the velocity of the earth through the ether.

If his statements are fully substantiated by scientific investigation a new era of science will commence, and the greatest secret of our time will approach revelation.

Such a revelation will of necessity be long in coming, for experiments upon such an intangible medium as ether—provided it does really exist—are extremely difficult to carry out, and research upon the subject must take place very slowly. The ether drift measurements need exceptionally delicate apparatus, and a large number of experiments extending over a considerable period of time will be necessary before any definite conclusions can be obtained and Einstein's theory be supported or disproved.



Part of the transmitting gear installed at W J R, a well-known American broadcasting station, which operates on 517 metres.



The Principles of Wireless Tuning

By Sir Oliver Lodge F.R.S.

This is the fourth of a series of articles by our Scientific Adviser. In this instalment he deals with some special conditions characteristic of the "N" Circuit. THE EDITOR.

THE primary object of tuning in wireless reception is of course selectivity; the aim being to listen to one station and to one station only, receiving and reinforcing the vibrations from that station, and excluding as far as possible everything else. To do that we must use a free vibrator accurately tuned, so that the slightest stimulus of its own frequency will make it respond, and so that it can only be forced to respond to other frequencies when their amplitude is exceptionally great.

No circuit can be quite immune from violent atmospheric disturbances, for they would force anything to vibrate in a momentary manner. Nevertheless, the smaller the connection between the collector and the resonating circuit the less likelihood is there of extraneous disturbances having any deleterious effect.

We cannot indeed use only the very summit of the peak of the resonating curve when that is very high and narrow, for there has to be a certain margin allowed for fluctuations of frequency at the sending station. The modulations of the carrier wave imposed upon it microphonically (which fluctuations must be received for good intonation, though they are extremely small) are not quite negligible. They are sometimes spoken of as "band frequencies," and a certain proportion of these must be admitted. Hence it is possible, though not easy, to get the tuning too sharp.

A Free Vibrator.

In practice, however, this does not involve any real difficulty. The resonating curve, if very slightly reinforced, is broad enough to give all that is required, and yet is narrow enough to exclude stations of even a slightly different permanent wave-length.

In the N circuit arrangement therefore we use a very sharply tuned perfectly free vibrator, and the slight reinforcement needed is secured by a device which does not look like reinforcement at all. There is nothing that could be called reaction, and there has to be not a trace of magnetic coupling. The more any such coupling is avoided the better, for when that is introduced the circuit is not completely free.

Undoubtedly the circuit must be connected to the grid of a valve; but a single connection suffices, and it acts on the grid only when by resonance the oscillations

have been worked up to a sufficient amplitude. To prevent the easy transmission of inaccurately tuned impulses, the condenser in the resonating or N circuit is kept small, and the inductance part of the circuit is big, so as to act as a choke to anything which is incompetent to work up oscillations of the desired frequency in the N circuit.

Connecting the N Circuit.

Then comes the question of how to connect the N circuit to the aerial collector. It would seem at first as if a single connection, with one and only one wire, between the aerial and the N circuit could not possibly work; and there seems no reason why the collected waves, having already a free path to earth, should give off part of their energy in a direction without any destination in rection, especially wire is interrupted small choke which puts a their obstacle in of lateral transmission.

Nevertheless, I found long ago in experiments on lightning

lateral having that if that by a denser, still further the path



"This photograph emphasises the tremendous strides made in the design of valves. A modern transmitting 'bottle' compared with Dr. Fleming's first valve."

conductors that when oscillations were going on in a completely short-circuited conductor of perfect conductivity, even though it were a copper rod an inch thick, that a side flash could be taken from it, not only to something connected to the earth, but to a knob or sphere or other conductor which was completely insulated.

Peculiarities of H.F. Impulses.

Such a side flash does not charge an insulated conductor: the flash consists of both charge and discharge; the potential is momentarily raised and immediately lowered again; so that even if the insulated conductor were a gold-leaf electroscope, receiving a spark (say) half an inch long, it would not be affected. The charge lasts so minute a fraction of a second, less than the millionth of a second, that gold-leaves have no time to diverge before they are neutral again.

In the same way it is known that very high-frequency alternations do not affect the nerves. Such a current can be transmitted to the human body, or can be applied to the nerve-muscle preparation of a frog's leg, without stimulating the nerve or producing any sensation, because the current is reversed again so quickly that the nerves have no time to respond.

The nerve receiving the impulse may be extremely sensitive, even to the fraction of a volt; and the muscle attached to it would contract violently with a small fraction of a Daniell cell conveyed to it through a potentiometer. And yet the same nerve under the same circumstances will fail to exhibit any disturbance—that is to say will be unable to stimulate the muscle when rapid alternations of millions a second are applied to it, even though the potential is 100, or even 1,000 volts.

Increased Amplitude.

But if, instead of employing what must be considered a slow responder like a gold leaf electroscope or a nerve, we employ as receiver a free resonator which has not to respond mechanically at all, but only electrically, then, when that free electrical vibrator is exactly in tune with the frequency of the applied alternations, then to that particular frequency the freely vibrating circuit will respond easily and vigorously.

The oscillations, being exactly in time, will accumulate and work up to an amplitude far beyond that of the disturbance applied. The applied alternations may be quite feeble, while the responding or worked-up oscillations are vigorous.

That, then, is the principle which we employ. The N circuit thus slightly connected as a lateral appendage

(Continued on next page.)

WORK AT 2 D A.

The "P.W." Experimental
Station.

(By the Engineer in Charge.)

2 D A is now quite often on 45 metres and would be very pleased to have reports from readers who hear the signals on this wave-length.

Some trouble was at first experienced when it was decided to employ this shorter wave. As a rule, 90 m. is the normal wave-length of 2 D A, and it was found that the aerial used for 90 m. work was not at all suitable for the lower wave-length of 45 m. Since it was desired, however, to use not only the 45 m., but also the 90 m. and 150-200 bands, an aerial had to be employed which would work equally well on each of these wave-lengths. After several experiments, it was found that an ordinary inverted "L" aerial, 60 ft. high by 70 ft. long, single strand, was the most satisfactory. For the 90 m. wave, a series '0003 condenser is required, but no series condenser is needed for the other waves.

Telephony Tests.

To begin with, a "Hertz" aerial was tried. This aerial was excellent on all wave-lengths excepting the one it was designed for! It was designed for 45 m., being 22½ m. long, the nearest to 45 m. which it would function was 30 m. Even when considerably lengthened, it would not oscillate much above 32 metres. However, on 90 m. it worked splendidly.

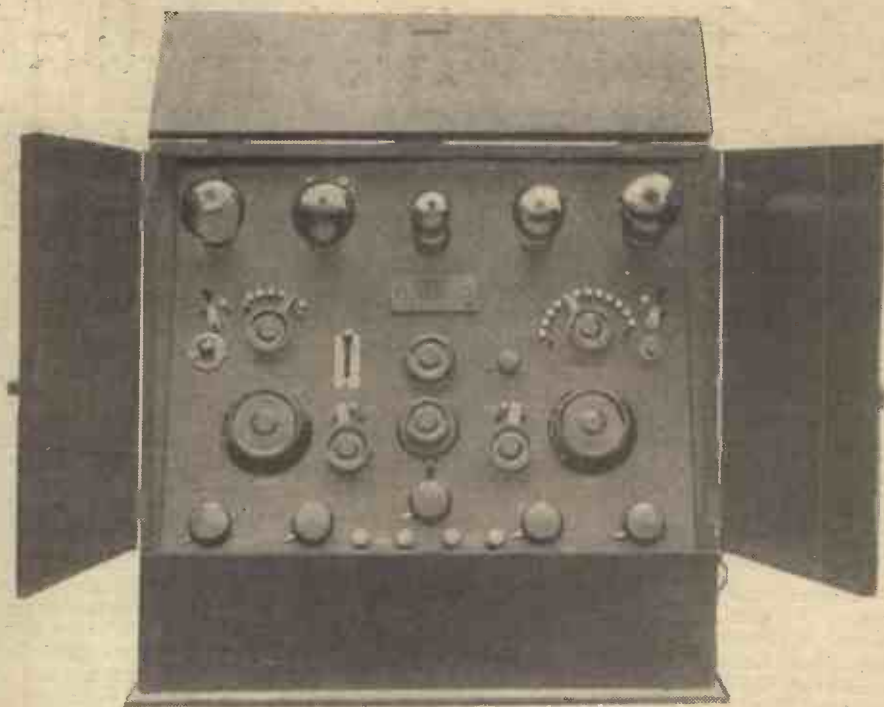
Several telephony tests are now carried out each week-end on 150 to 155 metres, and reports are particularly welcomed on these transmissions as only low power is used for the telephony side of the transmitter.

It is hoped soon to arrange a series of tests with several stations in U.S.A.; 90 m. will be the wave-length for these tests and will most likely take place at about 3.30 a.m. three days a week.

Interesting Valve Experiments.

Recently, several tests have been made with various well-known types of receiving valves, used as transmitting valves, for powers not exceeding 10 watts; the following valves are particularly suitable when only a low H.T. voltage is available: Osram L.S.5, Mullard P.M.3, B.T.H. B.4, B.T.H. B.6. All these valves work well on 200 volts H.T. and, with the exception of the L.S.5, they will take as much as 800 volts H.T., although the makers specify lower anode potentials. It is understood that the Mullard P.M.3 can also be had with a special base, making the valve even more suitable for a low powered transmitter.

By the way, 2 D A has cards for the following, which will be forwarded on application: G.610, G.5 S Y, G.2 A Y M, G.2 G C, G.2 B E R, G.2 X A S.



A five-valve set constructed by Mr. F. W. Phillips, of 41, Marine Avenue, Hove.

PRINCIPLES OF WIRELESS TUNING.

(Continued from previous page.)

responds only to oscillations of its own frequency, and those by resonance it reinforces.

If an N circuit could be made without any resistance at all, there is no limit to the amount of resonance which can be accumulated. The response ratio is theoretically infinite; for in such a case, in order to calculate the amplitude of the responding or excited vibrations, we have to divide the applied E.M.F. by the denominator $p^2 - n^2$, where p is the frequency of the applied or collected oscillations, and n is the natural frequency of the resonating circuit. Hence when these two frequencies agree, that is when n is tuned exactly to p, the denominator $p^2 - n^2$ is zero, and accordingly the whole expression is infinite.

Practical Considerations.

In other words, an infinitesimal applied oscillation will then produce a finite response; or, what comes to the same thing, a very small but finite applied disturbance will produce an infinite response. Hence an oscillating circuit with no resistance at all is infinitely sensitive to oscillations of precisely its own frequency.

That such a circuit of zero resistance could actually be made is not theoretically impossible, owing to the astonishing discovery of the late Dr. Kammerlingh Onnes, of Leyden, that certain metals at a temperature of liquid helium (only two or three degrees above the absolute zero of temperature) become perfect conductors. I fully anticipate that some day, as a curious laboratory experiment, a resonating circuit at a temperature close to absolute zero will

be tried; and I expect that such a circuit, however feebly stimulated, will respond and work up its oscillations to such a pitch that it will give sparks. Indeed, many remarkable experiments could be made if a really perfect conductor were available.

Returning to practical considerations, no such circuit is likely to be used, nor is it necessary. For, though any practical circuit must have resistance, yet that resistance can be kept small, and then a very small amount of regeneration will suffice to overcome the residual resistance and enable the circuit to work up its oscillations to anything short of self-exciting amount. We do not want a particular circuit to go on vibrating, any more than we want a piano string to go on vibrating when struck. We want it to respond and then cease, so as to be ready for the next impulse.

Hence there must be a certain amount of damping. The amount of regeneration must be kept slight, just enough to assist it to respond, and yet allow it to die out immediately afterwards.

The outcome of all this is that our N circuit is connected to the aerial in such a way that at first sight it would seem incompetent to respond at all, and it is regenerated in such a way that anyone would say there was no regeneration at all. We make use only of the feeblest lateral impulses, taking care that they shall never exceed a small value, and thereby obtain exceptionally clear and undistorted and selective results.

It must be understood that not every coil will oscillate satisfactorily as a free circuit without apparently adequate stimulus. If coils are tried at random, some will fail. In other words, some of the methods of winding in vogue serve the purpose, while others do not. To act satisfactorily, coils and condensers must be properly chosen, and other practical details attended to, on a basis of experience.

The MILAN Broadcasting Station



A general view of the aerial at the Milan broadcasting station.

IN the very centre of Milan, forming the focus of the commercial life of that important and romantic city, stands the immense broadcasting station, located in premises loaned to the Unione Radiofonica Italiana, the great Italian concessionaire company for radio broadcasting throughout the kingdom. The station is situated in Corso Italia, in the same premises as those occupied by the Adriatic Insurance Company.

The aerial-earth system is formed of a tubular antenna and a counterpoise. The masts are 100 and 120 feet in height, and were built by Messrs. Pasqualin and Vienna, a local company specialising in this class of work. The aerial is about 80 feet long and the down lead 90 feet. The counterpoise is formed of 80 crossed wires held by four longitudinal conductors, forming a slender network which reaches to a height of 65 feet above the ground. The counterpoise is situated in the court of the building. Because of the height of the counterpoise from the ground, the radiation resistance was very high on a fixed wave-length of 337 metres. Several attempts were made to reduce this resistance to a normal value. This was afterwards achieved by fitting in its place the Alexanderson system—i.e. by supplying the aerial with another down lead at its free end, and connecting it to the counterpoise across an inductance of a convenient value. In this way the aerial works in the manner of two in parallel, and a normal transmitting intensity of 13.5 amperes is obtained, which can be increased to 15 amperes if necessary.

The Transmitting Apparatus.

The transmitter, which is placed 65 feet above ground, is of the Western Electric 6A 1,000-watt type. A Kone loud speaker is employed for taking aural observations of the quality of the transmission, and is connected to a detector valve mounted on a small aerial in the same building. The water for cooling the transmitting valves is taken directly from the main distribution in the building; but, as a reserve plant, which, however, is not visible in the illustrations on pages 518 and 521, a group of motor pumps are adopted which bring the water into a small tank through a conduit furnished with a vacuum fan.

The conductors supplying the current for the transmitter are contained in iron tubes; these, earthed at the joints, descend to earth, and then pass up the elevator pit, and reach the transmitter in the adjoining building.

On the switch-board are mounted the starter, main switch, and various fuses. The instruments are not controlled in this room. "Tungar" rectifiers are supplied for charging the accumulators and heating the microphone amplifying valve. The cabinet mounted on the wall near the switch-board contains the switches controlling the above-mentioned batteries.

The Generators.

The motor-generator set is for a high-tension supply; the power is 8 h.p., and the two generators give each 2,000 volts. The first generator delivers the high-tension current for the three valves of the transmitter, while the second provides the high-tension for the water-cooled power valve.

The most important commercial city in Italy is now possessed of one of the most complete and well-equipped stations in Europe.

FROM OUR SPECIAL
CORRESPONDENT IN ITALY.

The 4 h.p. group supplying the filament current from the transmitting valves gives also negative grid bias.

The speech input equipment is composed of a 3-valve amplifier and a control panel.

Studio Arrangements.

In order to reduce the intervals between producing one piece and another, there are two studios—one large for orchestral selections, and the other small for solos and speeches. In the smaller studio, placed in the middle of the partition-wall, is a lamp, which, when lighted, gives the signal that the microphone is connected in circuit. There is also a large ante-room, which serves as a waiting-room for artistes, and in which is fixed a loud speaker in the same circuit as that of the amplifier.

The studios are not "blanketed" indiscriminately; the draperies are arranged so that a certain amount of echo is allowed. This is, of course, essential if natural tones are to be transmitted. It will be noted in the photographs that the ceiling of the main studio is only partially covered with draperies in order to obtain the above effect.

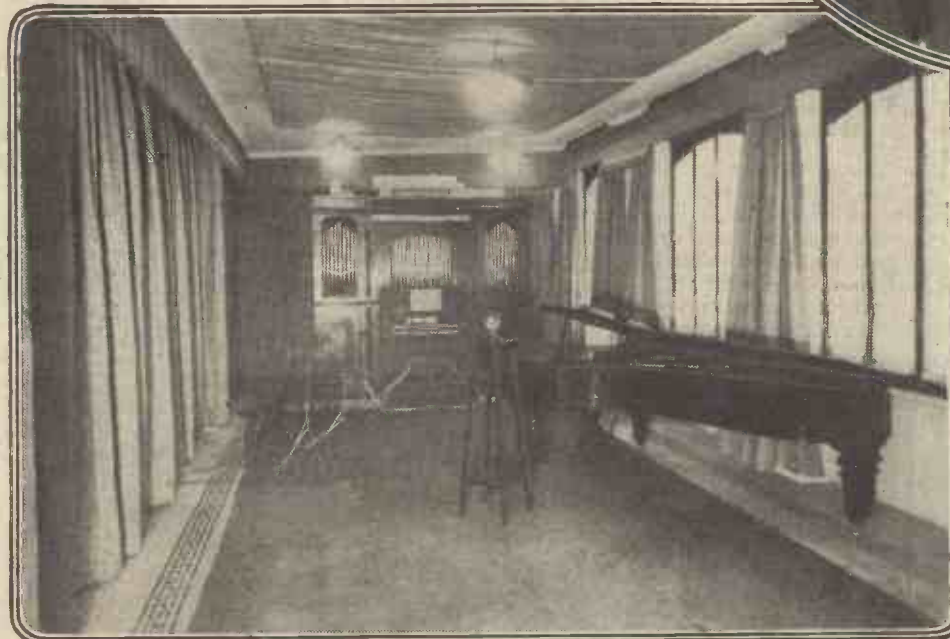


A view of the main studio at the Milan broadcasting station.



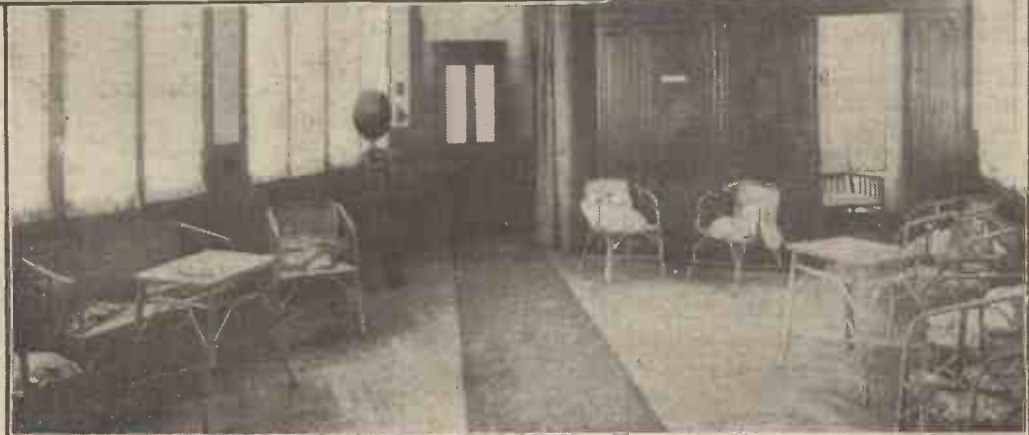
The artistes' waiting-room at the new Milan station.

The special piano studio. Special draperies are used for damping, and the piano microphone can be seen in the background.



Left, the main studio at the Milan station. A special organ for broadcasting has been installed.

Right, another waiting-room at the Milan station.



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BETTER RESULTS AT
A SIXTH OF UPKEEP COSTS

Osram D.E.8.

(H.F.) for 6-Volt Accumulators (L.F.)

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current consumption at 5.6 Volts



Characteristics : H.F. Type.

Filament Volts	- - - 5.6-6.
Filament Current	- - 0.12 amps.
Anode Volts	- - 40-120.
Impedance	- - - 25,000 ohms.
Amplification Factor	- - - 16.

Characteristics : L.F. Type.

Filament Volts	- - - 5.6-6.
Filament Current	- - 0.12 amps.
Anode Volts	- - 20-100.
Impedance	- - - 8,000 ohms.
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D.E.8 OSRAM VALVES
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Valve in the last stage.

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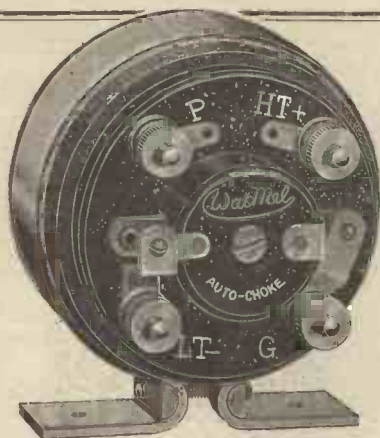
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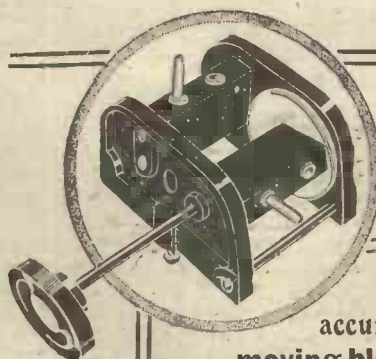
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Tuning is accurate because the moving block cannot fall

Holds the heaviest coil securely in position and prevents the fading away of volume. The vernier movement consists of three sets of enclosed precision machine cut gears and reduces the speed of the moving coil block by eight times.

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Makers of the new Lotus Buoyancy Valve Holder.

Bakelite mouldings for the side plates, coil plates and knobs and heavy nickel plating for the metal parts

The NEW "BEST WAY" Guide for Wireless Constructors



Details of the three splendid sets described in this "Best Way" Wireless Guide are given below. The book is amply illustrated with photographs and diagrams, and constructors will find the wiring directions most lucid and straightforward.

The All-Station Loudspeaker Portable

A remarkably compact six valve SUPER-HET. Aerial, batteries and loudspeaker all completely enclosed and permanently connected. This receiver will appeal strongly to motorists, Caravanners, River Parties, and seaside Bungalow-inhabitants.

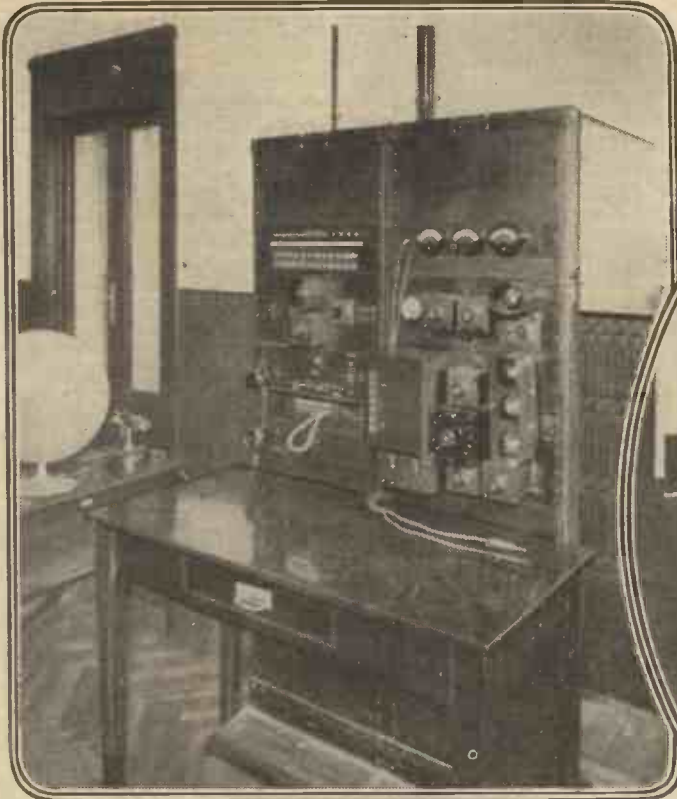
A Three-Valve Portable

Several stations on the loudspeaker and many on Telephone receivers can be obtained with this receiver. It employs a frame aerial which is built into the lid of its neat carrying case. It will prove popular among Motor Cyclists and other Road and River Tourists.

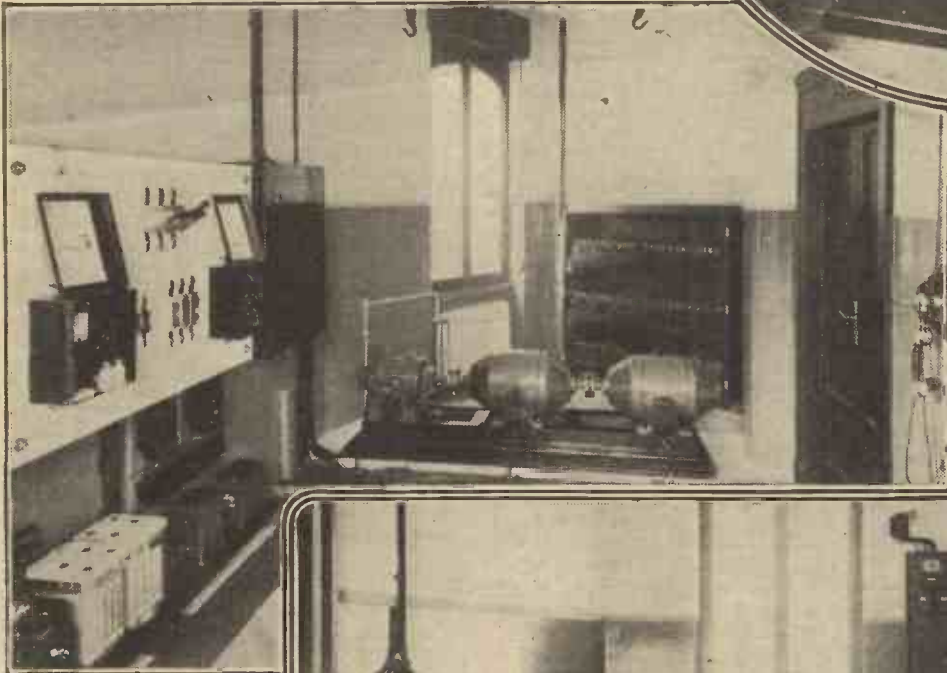
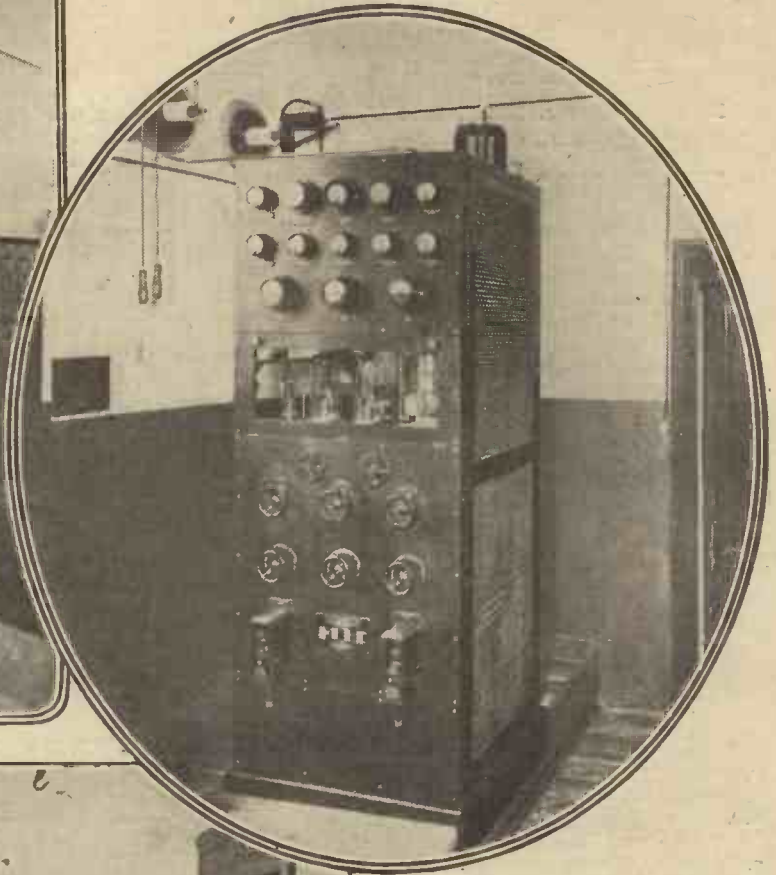
The Baby Portable

A two valve receiver contained in a very small attache case. Batteries and telephone receivers are enclosed and a reel of wire and earth pin for erecting temporary aerials are provided. This is the set for the Cyclist Holiday Tourer.

Now on Sale Everywhere. Buy a Copy To-day 6d.

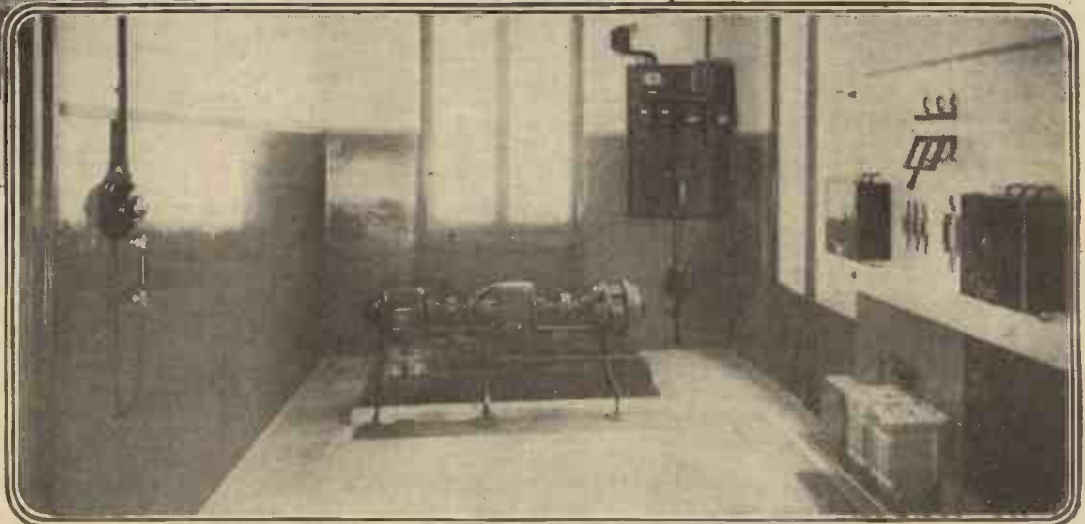


The control switchboard.



Above, the transmitting panel and lead-in insulators. Left, the accumulator room and charging plant. Below, another view of the accumulator room.

These photos have been supplied exclusively to "P.W." by our special correspondent in Italy, Mr. P. F. Martin F.R.G.S.



L.F. BY-PASS CONDENSERS.

An Article of Interest to all Amateurs.

By Lieut.-Comdr. H. W. SHOVE,
D.S.O., R.N.

MOST amateurs are familiar with the fact that a large "Mansbridge" type condenser should always be connected across the H.T. terminals of a valve receiver. The object of this condenser, is two-fold. First, to act as a "reservoir," the stored energy in which serves to smoothe out the direct anode current, and thereby to avoid the distressing "crackling" which is so apt to develop (and is often wrongly attributed to "atmospherics") as the H.T. battery gets past its first youth. Secondly, the condenser will often actually improve signal strength by affording a comparatively low impedance path to the L.F. impulses, which would otherwise have to overcome the resistance of the H.T. battery.

When Using Separate H.T.'s.

For both these purposes a large condenser is required, and a capacity of 1 to 2 mfd. is generally recommended.

Although most sets nowadays are provided with such a condenser across the whole H.T. battery, it is not so common to find the really correct method of bridging each section of the battery employed. The old inefficient practice of providing but one pair of H.T. terminals on a multi-valve set is happily fast becoming obsolete. But many sets, though fitted with taps allowing of the correct voltage being applied to each valve, leave those of the detector and H.F. unbridged. A moment's thought will show that this is wrong. For the positive plate of the condenser across the L.F. (or highest) voltage is separated from the lower taps by a large section of, perhaps, high resistance, cells, and the smoothing effect (to say nothing of the by-passing) is therefore destroyed so far as those valves are concerned. The proper arrangement for a "standard" three-valver is as shown in the Fig., C_1 , C_2 , and C_3 being the Mansbridge condensers for H.F., Det., and L.F. anodes respectively.

Protecting the Loud Speaker.

Ideally, all three condensers should be as large as possible. But actually, the current to be smoothed in the H.F. and Det. stages being less, it is often quite satisfactory (and, of course, more economical, both in cash and space) to use smaller (say .25 mfd.) condensers here. But .25 mfd. should be regarded as a minimum, since smaller sizes do not by-pass the L.F. currents satisfactorily.

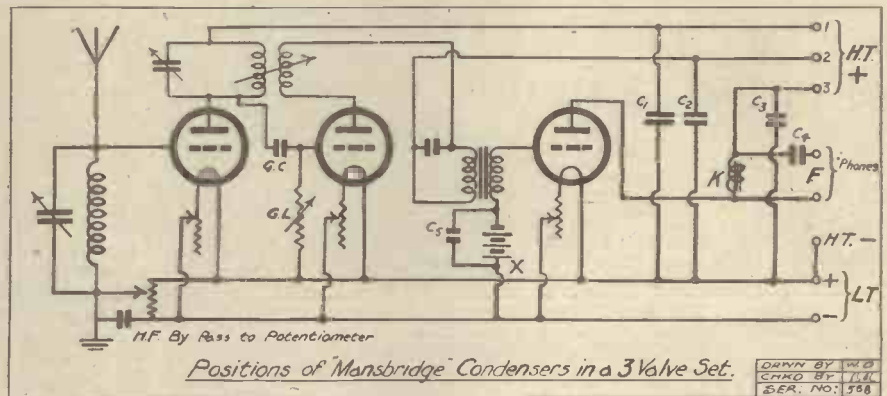
A second use for the .25 (or larger) Mansbridge condenser as an L.F. by-pass is in connection with a "filter" circuit. Where a high resistance loud speaker (or 'phones) is used on a multi-valve set, and with a high anode voltage on the last valve, such a filter should always be fitted. The arrangement is shown in the Fig. at F, C_4 being the Mansbridge condenser, and K an iron-cored choke. Any high inductance coil

will do for the latter, the function of which is simply to allow the passage of the D.C. from the H.T. battery, while preventing, so far as possible, that of the L.F. impulses, which then travel through the condenser and loud speaker. The sound winding of a burnt-out L.F. transformer makes as good a choke as anything. In addition to protecting the delicate windings of the loud speaker from damage by the heavy D.C., the filter circuit serves to prevent distortion due to the magnetic saturation of the iron pole pieces. It will thus be found that surprisingly loud signals can be effectively handled, even by quite a small instrument.

An Unusual Arrangement.

So much for the anode circuits. But there is one point in the grid circuit of an L.F. valve where a .25 mfd. condenser has not (so far as the writer knows) before been

advocated, but where he has found it of great service in improving both strength and quality of signals, viz., across the grid bias battery. It is assumed that every up-to-date amateur invariably uses grid bias for telephony reception. If he does not he cannot hope for good quality of strong signals. As a rule the cells are fitted in the position shown at X in the Fig. They are generally of small size, often old and of high resistance. So that the arguments for a by-pass condenser here are only less than for one across the H.T. battery because the number of cells is less. But with modern power valves the grid bias may be anything up to 25 volts or so, and the resistance losses in such a battery may be considerable. The writer now always (even with grid bias as low as $4\frac{1}{2}$ volts) uses a .25 mfd. condenser in this position (C_5 in Fig.) with markedly good effect.



TRANSFORMER CONNECTIONS.

THERE are four different ways of connecting any transformer into an ordinary straight circuit, any one of which may be much better than the other three. This applies more especially to L.F. transformers, but cases often occur where a great deal can be gained by reversing the connections of an H.F. transformer, so if either of these components is in use in your receiver, it is a good plan to make sure that it is connected the best way round for results.

The importance of correctly relating the connections has lately been realised by manufacturers, and a good many transformers are now plainly marked before leaving the factory, to indicate how they should be placed in circuit. When the instrument is labelled "P.," "G.," "H.T. Plus," and "G.B." (in the case of an L.F. transformer) it is obvious that the corresponding connections are to plate (generally via the reaction coil), grid, H.T. +, and to the grid bias tapping. But when the transformer markings are merely "O.P.," "O.S.," "I.P.," and "I.S.," it is quite probable that it has been connected up in such a manner that, whilst it is now working as far as getting signals through is concerned, it might be working very much better.

Not everyone knows the meaning of O.P. and I.P., and even when the owner is

aware that these letters stand respectively for outside primary, and inside primary, he is not able to say from this which of these is the better to connect to H.T., and which to plate, nor whether I.S. or O.S. should go towards grid. There is no rule which can cover all cases, owing to the variations in manufacture, so it is as well to try all the four ways, to see which gives best results.

Where Care is Necessary.

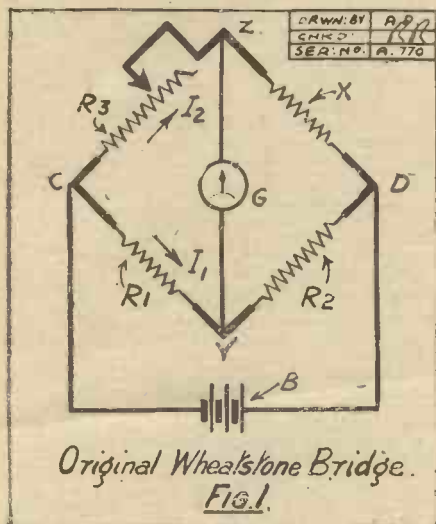
The easiest way of doing this is to provide the four transformer terminals with four suitable lengths of flex, and change the connections over systematically. Needless to say neither of the primary leads should be confused with the secondary ones, or you may short the H.T. battery, and possibly burn out a valve. To avoid this possibility, take out the H.T. negative plug before every change-over is made.

Commence by connecting O.P. to plate, and I.P. to H.T., and then complete the secondary connections first with I.S. to grid, and then with I.S. to L.T. (or the grid-bias tapping, if used). Having tried these two ways, and carefully noted which is better, alter the direction of current through the primary by transferring I.P. to plate and O.P. towards H.T. Then I.S. and O.S. should be changed over again as before, noting which way gives maximum results. Finally, the latter connection should be compared with the one giving best results when O.P. is connected to plate, and this comparison will decide which is the best connection for the transformer in your receiver.

IN spite of its many virtues, the valve amplifier appears to have a rooted objection to what may be called team work. Taken alone, or in the standard tandem combination, H.F., detector, L.F., it is fairly easily managed, but the addition of any further stages, particularly on the H.F. side, produces decided instability and a distinct tendency to get out of control.

Action of the Bridge.

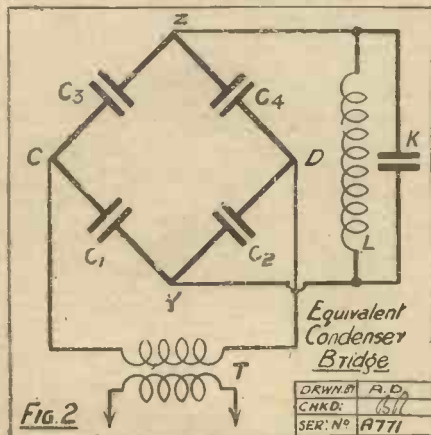
Until recently, two successive stages of tuned or transformer-coupled H.F. amplification made quite a formidable combination to handle, but the introduction of radio-frequency balancing methods, such as employed in the well-known neutrodyne circuit, has placed the whole problem on a



new footing. The new methods are, in fact, derived from the well-known principle of the Wheatstone resistance bridge, although the direct connection between the two does not at first sight appear obvious.

The resistance bridge was originally devised for the purpose of measuring resistances. Essentially it comprises three resistances, R_1 , R_2 , R_3 (Fig. 1) of known value arranged to form three sides of a square, the unknown resistance X occupying the fourth side.

A battery, B , is connected across one



RADIO-FREQUENCY BALANCERS.

FROM WHEATSTONE BRIDGE TO NEUTRODYNE.

By SEXTON O'CONNOR.

diagonal of the square, and a sensitive current indicator, such as a galvanometer, G , is connected across the other diagonal. The resistance R_3 is made variable, as indicated by the sliding contact.

In using the instrument for measuring the Resistance X , the slider R_3 is adjusted until the galvanometer G gives a zero indication. The resistance R_3 is calibrated so that its adjusted value can be read off, and the value of resistance X then bears the same ratio to the resistance R_3 as R_2 bears to R_1 . If the two latter are equal, X is obviously equal to the adjusted value of R_3 .

Assuming for the moment that the indicator G is disconnected, then the current from the battery B divides into the two paths R_1 , R_3 and R_2 , X . If the resistances R_1 , R_2 are equal, the voltage at the point Y , due to the passage of the current I , will be half that of the battery. Similarly, the point Z will be at half the battery voltage if R_3 is equal to X .

Under these conditions the points Y , Z will be at the same voltage, and no current will pass through the indicator G when this is again connected up.

The important point to notice here is that when the balancing adjustment is once made, the indicator G and the battery B are "dissociated" one from the other. Any alteration in the battery circuit, such as changing its voltage or reversing its connection, will produce no effect on the indicator.

Balancing Capacities.

If, for instance, the battery is reversed fifty times per second, thus converting it into an alternating source, there is still no effect on the indicator. Moreover, if other resistances or impedance elements, such as inductances or condensers, are substituted for, or connected in series with, the indicator G , these added elements will not be affected by any alternating potential applied in place of the battery B .

This is so because the voltage at Y remains equal to that at Z , and there is therefore no tendency for current to pass through any circuit connecting them. It is also interesting to note that the balance is reciprocal, voltages applied across the points Y , Z producing no effect on a circuit connecting the points C , D .

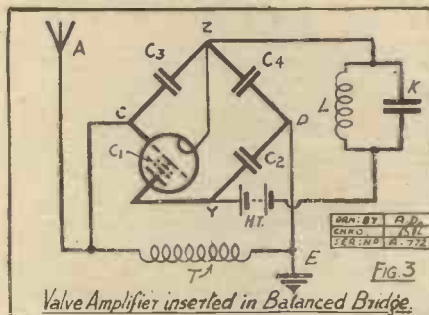
An equivalent capacity balance is shown in Fig. 2. Condensers C_1 , C_2 , C_3 , C_4 are connected in the sides of the square, whilst an alternating voltage (such as that from the secondary coil of a transformer T) is applied across the diagonal CD . As before, the alternating current divides into two branches, C_1 , C_2 and C_3 , C_4 . If C_1 is equal to C_2 and C_3 to C_4 , then the voltages at the points YZ will both be midway between

those at C and D . Consequently, there is no tendency to produce a current through any circuit (such as the tuned loop KL) connecting the points Y , Z . The condition for balance is that the ratio of C_1 to C_2 must be the same as the ratio of C_3 to C_4 . Precisely the same conditions hold good if the capacities are replaced by inductances.

The direct application of the balancing principle of the Wheatstone bridge

in the case of the neutrodyne circuit will now perhaps be clear from the following explanation.

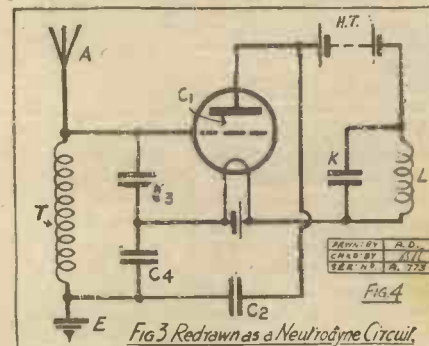
It is well-known that self-oscillation is set up by the back-coupling of the plate circuit of a valve to the grid circuit, through the electro-static capacity existing between the electrodes inside the bulb. In order to



avoid this trouble, steps are taken to completely dissociate the grid and plate circuits.

Origin of the Neutrodyne.

With this object the grid input circuit, as shown in Fig. 3, is connected across one diagonal CD of the bridge (taking the place of the transformer T of Fig. 2) and the plate circuit across the other diagonal ZY (in place of the circuit LK of Fig. 2). The condenser C_1 is replaced by the internal grid-to-plate capacity of the valve, the grid being connected to C and the plate to Y . As LK is to be the plate circuit and one end is already connected to the plate at Y , the other end must be connected to the



filament at Z . The presence of the H.T. battery in the plate circuit does not affect the balance of the bridge, as it has a negligible H.F. impedance.

The capacity C_2 becomes the neutrodyne or balancing condenser, and the capacities C_3 , C_4 are connected in series across the input coil T . The circuit as redrawn in (Continued on next page.)

RADIO-FREQUENCY BALANCERS.

(Continued from previous page.)

Fig. 4 can more readily be identified as one of the standard forms of the neutrodyne circuit.

The condition for balance is that the ratio of C_3 to C_4 must equal the ratio of C_1 to C_2 . Accordingly, if the condensers C_3 and C_4 are equal, then the balancing condenser C_2 must be equal in value to the inter-electrode capacity C_1 . In practice it is usual to add to the value of C_1 by including a small additional condenser across the grid and plate, so that the neutrodyne or balancing condenser C_2 is increased to manageable dimensions.

It should be remembered that the above considerations apply independently of the ordinary thermionic amplifying action of the valve, being concerned with the effects of capacity coupling only. The balance obtained is accordingly effective whether the electron stream is present or not—i.e. whether the valve filament is hot or cold.

Preventing Interference.

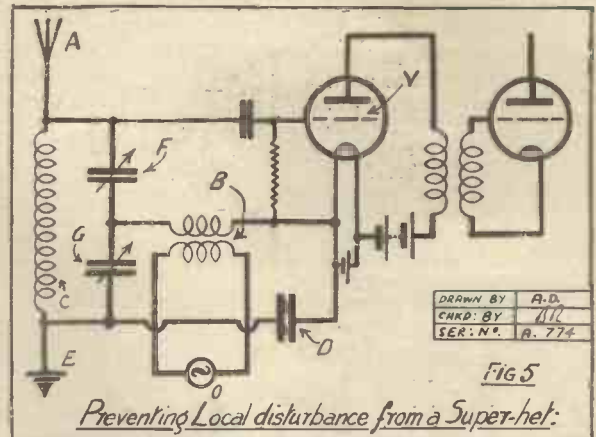
The "radio-frequency balance" is also used in the latest arrangements for preventing local disturbance from a receiving aerial due to oscillations generated in the receiving set for the purpose of heterodyning the incoming waves. This is a problem of particular importance in connection with superheterodyne receivers. The local

the grid (through the usual grid condenser and leak, if the valve is to rectify), and the earthed end of the coil, C , is connected through a capacity, D , to the filament.

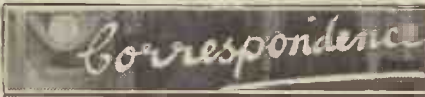
This capacity should balance the grid filament capacity and may, in the case of a detecting valve, be shunted by a high resistance to compensate for the grid-filament resistance of the valve.

The circuit is redrawn in Fig. 6 as a balanced bridge, with the input coil, B , for the local oscillations connected across one diagonal, and the aerial-earth capacity and inductance coil, C , connected across the other. The condenser, D , is in one arm as a balance to the grid-filament capacity of the valve, and the divided capacities F , G form the other two arms.

If F and G are equal, then the condition



for a true balance is that the capacity of D should equal that between the grid and filament. Once this balance is struck, the aerial circuit is dissociated from the local input coil, B , and any H.F. energy flowing in this coil cannot be communicated to the aerial.



Letters from readers discussing interesting and topical wireless events or recording unusual experiences are always welcomed, but it must be clearly understood that the publication of such does in no way indicate that we associate ourselves with the views expressed by our correspondents, and we cannot accept any responsibility for information given.—Editor.

UNIDYNE SHORT-WAVE SET.

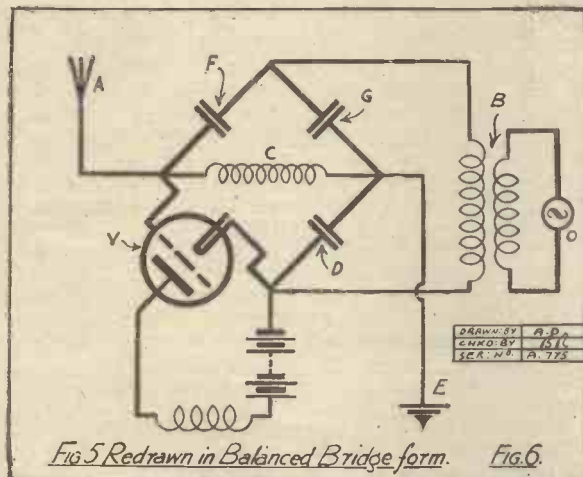
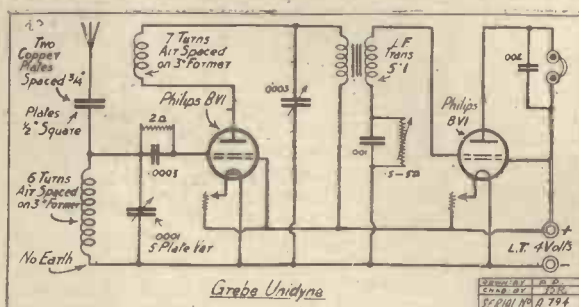
The Editor, POPULAR WIRELESS,
Dear Sir,—During the course of experimentation I came across a very interesting Unidyne development and I feel sure that Messrs. Dowding and Rogers, as the originators of Unidyne circuits, will be interested.

Being a Unidyne enthusiast of the deepest dye, I have for some time now been considering the feasibility of building an ultra low-wave Unidyne. This became not only an obsession, but a dire necessity as H.T. batteries were a continued source of annoyance, and would simply not stand up to our climate. So I seriously thought of applying either Reinartz or Grebe types of reaction to Unidyne theory.

I tried her out on low-wave Morse a few evenings, and she excelled herself, and signal strength was R5-R6. This hook-up is still in the experimental stage.

I am, however, expecting two Geocophone low-loss slow motion variables, and am adapting 2 O.D.'s 10-metre lay-out as the basis for my Grebe Unidyne, and when this is completed I expect a huge increase in efficiency.

Reception, I think, savours of a double record, viz. :



oscillator is, of course, an essential part of every supersonic receiving set, and the radiation of the waves generated by it is liable to cause interference with neighbouring receivers.

In the arrangement shown in Fig. 5, due to Mr. P. W. Williams, the aerial, A , is connected to the grid circuit of the first detecting valve, V , and the local oscillator, O , also supplies energy to this valve through the coils, B . Obviously, unless special precautions are taken, the local oscillations will circulate in the aerial and so get into the ether.

To obviate this, the tuning condenser for the aerial is divided into two portions, F , G , and the mid-point is connected to the filament through the secondary coil, B . The aerial end of the coil C is connected to

- (a) American telephony on 41 metres with Unidyne.
- (b) Telephony reception at any distance, using a 4-volt accumulator as sole juice supply.

Have run through 1926 Unidynes and they are real "hot."

I append theoretical diagram of Grebe Unidyne for your perusal and comment.

Wishing you all the best and thanking you for Unidyne circuits.

I remain, with best 73's,

Yours faithfully,

F. C. RETIEF,

P.O., Bulwater, via Fraserburg Road,
Cape Province, South Africa.

THE "P.W." BLUE PRINTS.

The Editor, POPULAR WIRELESS.

Dear Sir,—The following might be of interest to you. I built up a 1-V-1, from "P.W." Blue Print No. 19, got good reception from our local station right away. I am about two air miles from Cape Town. I tuned in Johannesburg, just on 1,000 miles, and got very fair loud-speaker results—this, mark you, whilst C.T. was on the air! Wishing POPULAR WIRELESS the best of luck. Needless to say I am a regular reader.

Yours faithfully,

C. R. SLINGSBY,

P.O. Box 367,
Cape Town, South Africa.

BATTERY ELIMINATORS.

The Editor, POPULAR WIRELESS.

Dear Sir,—In consequence of the increasing use of eliminators operating from the electric lighting circuit in place of H.T. dry batteries, I should like to suggest the desirability of you calling attention in your paper to the importance of good insulation on headphones should headphones be used in association with an eliminator.

My reason for writing you is that I recently came across the case of a person who suffered a very severe nervous shock by reason of the fact that there was a low insulation between the coils on the head receiver and the metal headband.

Of course, an unpleasant shock might equally have occurred had there been an H.T. battery of 100 volts or over used, but as an eliminator on a 200-volt circuit was used, you can imagine that the effect was very unpleasant, and had the person had a weak heart, the results might have been very serious.

I hope that you will consider it desirable to call attention to the necessity of making certain that the insulation on the headphones is good before use.

I am aware that where eliminators are used it is generally in association with a loud speaker; at the same time in the interests of the wireless trade, it is necessary that attention should be called to the importance of good insulation of the headphones.

Yours faithfully,

M. H. GOLDSTONE,

Frederick Road,
Pendleton, Manchester.

(Continued on page 532.)



Unexcelled in purity and richness of tone

ONE has heard Loud Speakers likened to the early gramophone with its harsh, metallic tone; one has, however, never heard the Brown spoken of in this manner. The name Brown is synonymous with all that is best in radio reproduction—its pure unadulterated tone and its faithful, accurate rendering of every phase of the broadcast is a byword among those who know this, the first Wireless Loud Speaker.

If you do not know the Brown, you have yet to hear true radio interpretation. See and hear the Brown at your nearest Dealer's. You will at once appreciate the unusual beauty of its outline; but *hear it* and you will know that such rich volume and purity of tone is available in no other instrument.

Brown LOUDSPEAKERS

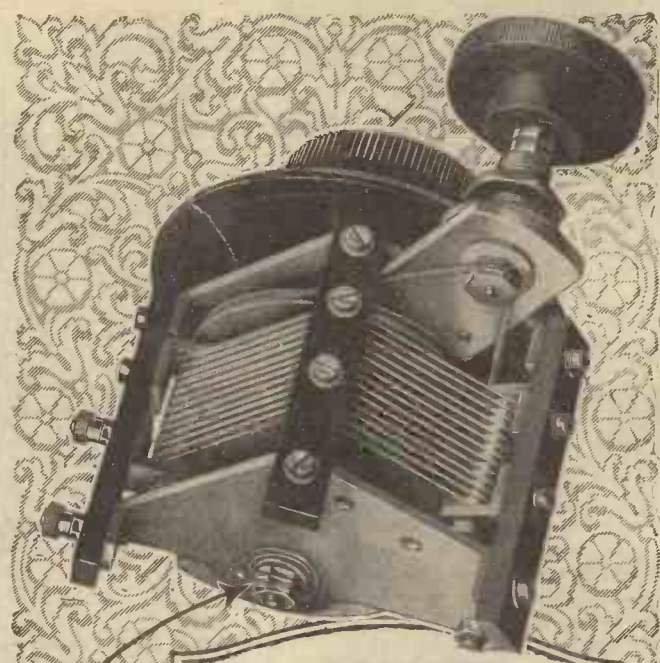
Type H.1. 21 ins. high. 120 ohms £5 5 0 2,000 ohms £5 8 0 4,000 ohms £5 10 0	Type H.2. Height 12 ins. 120 ohms £2 5 0 2,000 ohms £2 8 0 4,000 ohms £2 10 0	Type H.3. 15 ins. in height and in resistance of 2,000 ohms. £3 0 0	Type H.4. The smallest Brown Loud Speaker. Only 10 ins. high. 2,000 ohms £1 10 0
Type H.Q. 20 ins. high. Resistance: 2,000 or 4,000 ohms. £6 0 0	Type Q. 23 ins. high. In resistances of 120, 2,000 or 4,000 ohms £15 15 0	Cabinet Type. In Mahogany or Oak Cabin- et, 2,000 or 4,000 ohms £6 6 0	Crystavox. The only Loud Speak- er which works from a Crystal Set £6 0 0

Brown HEADPHONES

Type A. As used by the Admiralty 120, 2,000 or 4,000 ohms £2 10 0 8,000 ohms £3 0 0	Type F. Popular Broadcast type. Weight only 6 ozs. 2,000 ohms £1 0 0	Type A.2. The New reed-type unequalled for sensitive- ness. 2,000 ohms £1 10 0
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COMPENSATED
SQUARE LAW
EFFECT

LOW LOSS

NO
BACK LASH

LOW LOSS SQUARE LAW SLOW MOTION

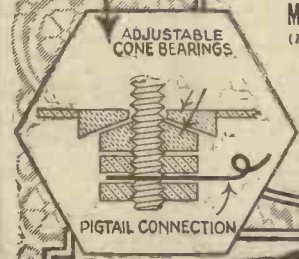
THE "Cosmos" Condenser is a slow motion condenser with absolutely no back lash, either when new or after use. This desirable feature is accomplished by the use of a spring belt held in tension, which permits coarse tuning with the large knob, and a 10-1 slow motion with the small knob. Cone bearings allow for adjustment and the slow motion bracket can be mounted for remote control as shown in the lower illustration.

The condenser for fine tuning.
METRO-VICK SUPPLIES LTD.
(Proprietors: Metropolitan-Vickers
Elec. Co., Ltd.).

METRO-VICK HOUSE,
145, Charing Cross Road,
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PRICES.

Slow Motion	-00025 mfd.	14/9
	-0005	15/6
Ordinary	-00025	12/-
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COSMOS



Traders and manufacturers are invited to submit wireless sets and components to the "P.W." Technical Dept. for test. All tests are carried out with strict impartiality in the "P.W." Test Room under the supervision of the Technical Editor, and the general reader is asked to note that this weekly article is also intended to provide a reliable and unbiased guide as to what to buy and what to avoid. —EDITOR.

JARS FOR H.T. UNITS.

OLD H.T. batteries should not be thrown away, for, providing that they were fairly well made, their small "sack" elements can be used to form a new battery. All that is required is a quantity of sheet zinc (about 26 gauge) and a number of small jars. The zinc can be obtained from almost any general ironmonger, and now the H.R.P. Co., of 46, St. Mary's Road, Leyton, E.10, inform us that they are prepared to supply glass jars especially made for the purpose. The retail prices are 1s. per dozen plain and 1s. 3d. per dozen with their tops waxed to prevent creeping. Samples were submitted to us and in our opinion they are quite suitable for the purpose and are priced exceedingly reasonably. The advantages such a battery offers are that it is cheap and that it can be renewed as many times

as necessary. Wet Leclanchés are indeed particularly suitable for supplying H.T., and the H.R.P. people should do a good trade with their neat little jars.

THE "CLAREBEX" AERIAL.

We recently received a "Clarebex" aerial for test from H. J. Saneto, of Ticehurst, Sussex. It consists of a square block of wood with holes at each corner to hold "T" pieces, and a large centre hole for mounting it on a pole. The parts are supplied unassembled but no tools are required to piece them together. The "T" pieces, ten in number, are lettered, as are the holes in the wooden block. The arms of the "T" pieces are slotted, two centre ones having six and the remaining eight three each.

When the wire, which is provided, is wound on the result is a cage aerial some-

what similar to a very much spread out frame. The design is quite logical and one that is theoretically sound. Naturally the higher the aerial is placed the better are the results. Fixed on the top of a 30 ft. pole reception was well up to standard. The "Clarebex" should prove popular among those amateurs whose garden space is restricted or who prefer not to have a visible aerial, for it can be erected in an attic or under a roof and will still act as a good "collector." The price is 17s. 6d. complete.

AN ARTISTIC LOUD SPEAKER.

Wireless apparatus is ever tending to the artistic, and in these days both receivers and accessories are being modelled on



The commercial model of a wireless photograph receiver which, it is stated, is shortly to appear on the market.

decorative rather than on laboratory lines. Naturally, most people prefer an efficient piece of gear that is "camouflaged" to an efficient instrument that (Continued on page 528.)



Where there's a child there should be cocoa

CHILDREN are brain-workers and manual workers too, and many overgrow their strength at school and play. Now Cocoa is food, and gives the children extra strength to keep pace with their growing bodies. It is the children's idea of a really delicious drink for breakfast and supper.

"Keep fit
on cocoa"

BOURNVILLE
By test the best

See the name "Cadbury" on every piece of chocolate

SCRAP HIGH-TENSION BATTERIES!



THE **EKCO** HT UNIT
(PATENTS APPLIED FOR)

Derives H.T. from the mains (D.C.) by just attaching adaptor to electric light lamp-holder!

SAFE! SILENT! SOUND!
ENSURES PERFECT RECEPTION
(NEGLECTIBLE RUNNING COSTS)
A SILENT "BACKGROUND"

Model.	Tappings.	Set suitable for	Price.	Postage and Packing.
1	1	1 to 3 valves without power valves	35/-	1/6
1A	1	1 to 3 valves with power valves	42/6	
2	2	1 to 3 valves without power valves	47/6	
2A	2	3 to 6 valves with or without power valves	55/-	
3	3	3 to 6 valves with or without power valves	67/6	
3A	3 or 4	Marconi "Straight 8," Multi-valve and Super-het.	£6/8/0	

E. K. COLE (Dept. A), 505, London Road, WESTCLIFF-ON-SEA.



Two in One!

The new Dual Rheostat = a "Peerless" product in every way. Specially designed to meet the demand for a resistance equally applicable to bright or dull emitters. It has two windings—one offering a resistance of 6

ohms, whilst a continuation of this is of 30 ohms resistance. The resistance element is wound on a hard fibre strip under great tension. One hole fixing is provided and the terminals are placed in convenient positions. The contact arm has a smooth silky action, and all metal parts are nickel-plated.

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**THE BEDFORD ELECTRICAL &
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IMPROVES ANY SET



TUNE IN WITH SUMMER

THE west is still luminous with the sunset's afterglow, and the "love-set" is abandoned for another.

Across the court comes the call of dance music, and white shoes weave a rhythmic pattern on the grass.

Youth will be served, and Ediswan Valves have given to the heart of youth the soul of music.

Ediswan Valves give the extra volume for outdoor reception, while preserving the purity of tone of the most carefully installed indoor set.

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S.V. 3



This is the Glory Corner at the Bennett College. We give it that name because it contains in bundles about One Hundredweight of letters which we have received from Grateful and Successful Students. We keep all these thousands of unsolicited testimonials as a fountain of inspiration and because we are really proud of them. Having helped thousands of others to achieve success and advancement, it may be possible that we can help YOU.

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It is made from
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It proves its
quality in every
test. Its polish
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THE BRITISH EBONITE CO., Ltd., HANWELL, LONDON, W.7.

APPARATUS TESTED.

(Continued from page 526.)

resembles a lump of crude machinery, when it comes to introducing radio to the drawing-room. In studies and "dens" it doesn't matter so much, but "Lewis Cans" schemes of furnishing can be ruined by quite small divergences from the *tout ensemble*.

For this reason, the new "K" 'phone reproducer due to Messrs. Ellerphones, Ltd., of Beacon Buildings, New Road, Kendal, should prove distinctly popular. It is a loud speaker designed in a manner which will appeal strongly to all those listeners who desire to preserve the æsthetic compositions of their *salons* without sacrificing their radio.

No horn or even a bland disc figures in the "K" 'phone; it is quite unlike any other loud speaker. In fact, in appearance, it is an *objet d'art*, being a stately metal vase of Grecian simplicity and effectiveness. Placed on a high pedestal in a dining-room with concealed exterior leads, no one would suspect that it was anything else but a nice, tasteful piece of artistic furniture. In operation it is bewilderingly effective, for it does not appear to have any directional effect, and the music and speech might as well be coming from a table leg or door knob as the artfully designed "K" 'phone reproducer. And it is sensitive, too, and throws off enough volume to fill a large room with but a moderate input of power. Not like some

"camouflaged" loud speakers, it loses no efficiency in its artistic contours—indeed, it appears to gain in this respect. It has negligible resonance periods and reproduction is clear, and speech and music come through with commendable fidelity. Two models are available, one with an oxidised copper finish at £4 10s., and another, finished in oxidised silver, at £5.

If all "K" 'phone reproducers are up to the standard of the sample submitted us, and there is little reason why they should not be, Messrs. Ellerphones should have a busy time meeting demands for them. Anyway, readers of "P.W." contemplating the purchase of a new loud speaker should endeavour to see a "K" 'phone and hear it in operation; they will then be able to form their own personal conclusions as to the instrument's appearance and efficiency.

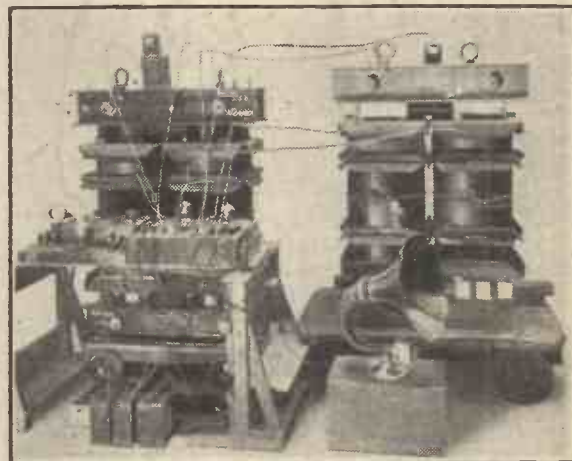
A C.A.V. DEVELOPMENT.

In view of the recent amalgamation of important electrical concerns, West Country readers will no doubt be interested to learn that ample stocks of all C.A.V. radio apparatus, including accumulators, are now obtainable at their usual terms from the branch of Rotax (Motor Accessories) Limited, 7, Temple Street, Bristol. Messrs. C.A.V. also inform us that they are endeavouring to give a similar service in connection with their wireless products as that which is being inaug-

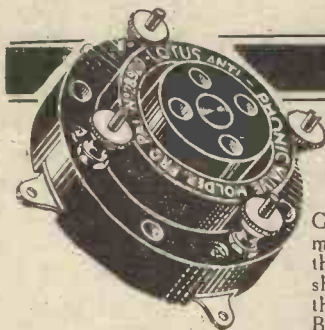
urated all over the world for their car productions.

PHOTOGRAPHS.

Readers are invited to submit photographs of wireless interest for publication in "Popular Wireless." Every photograph accepted and published will be paid for at the rate of 10/6 per photo.



These two 150 KVA Ferranti power transformers are being used in a receiving circuit. It is stated that nearly perfect results were obtained. The "components" are not suitable for portable sets!



Get Rid of Valve Trouble

Get rid of these disturbing microphonic noises—prevent the danger of breakage from shock. Ask your dealer for the new improved Lotus Buoyancy Valve Holder, which absorbs shock and protects your valves.

Valve sockets and springs are locked together by a mechanical process, making a definite and permanent connection. Bakelite mouldings, nickel silver springs and phosphor bronze valve sockets, nickel-plated.

Without
Terminals
2/3

With
Terminals
2/6

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VALVE HOLDER
ANTI-MICROPHONIC

Garnett, Whiteley & Co., Ltd.,
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A twelve months GUARANTEE

Such good workmanship and care is used in making these Transformers that each one is fully guaranteed for twelve months. If it is not entirely satisfactory in use it will be exchanged without charge.

Ranges are made covering all wavelengths from 150 to 2,000 metres and up, as well as a special Neutrodyne Unit.

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Each

BOWYER-LOWE
H.F. TRANSFORMERS

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Invaluable to EVERY Amateur and Constructor.

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Every wireless amateur and every wireless constructor will find these "POPULAR WIRELESS" Blue Prints absolutely reliable. They have been most accurately drawn, and every circuit has been tested under normal broadcasting conditions by the technical staff of "Popular Wireless." It will be seen from the complete list given below that the series covers a very wide field. The veriest tyro will find each print most straightforward to follow and the receivers most easy to construct.

P.W. BLUE PRINT
Number

1. DETECTOR VALVE WITH REACTION.
2. UNIDYNE DETECTOR VALVE WITH REACTION.
3. 1-VALVE L.F. AMPLIFIER.
4. CRYSTAL DETECTOR WITH L.F. AMPLIFIER.
5. H.F. (Tuned Anode) AND CRYSTAL, WITH REACTION.
6. H.F. AND CRYSTAL. (Transformer Coupled, Without Reaction).
7. 1-VALVE REFLEX WITH CRYSTAL DETECTOR (Tuned Anode).
8. 1-VALVE REFLEX AND CRYSTAL DETECTOR (Employing H.F. Transformer, without Reaction).
9. H.F. AND DETECTOR (Tuned Anode Coupling, with Reaction on Anode).
10. H.F. AND DETECTOR. (Transformer Coupled, with Reaction).
11. DETECTOR AND L.F. (With Switch to Cut Out L.F. Valve).
12. DETECTOR AND L.F. UNIDYNE (With Switch to Cut Out L.F. Valve).
13. 2-VALVE REFLEX (Employing Valve Detector).
14. 2-VALVE L.F. AMPLIFIER (Transformer coupled with Switch to Cut Out Last Valve).
15. 2-VALVE L.F. AMPLIFIER (Transformer-Resistance Coupled with Switch for Cutting Out Last Valve).
16. H.F. (Tuned Anode), CRYSTAL DETECTOR AND L.F. (with Switch for Last Valve).
17. CRYSTAL DETECTOR WITH TWO L.F. AMPLIFIERS (with Switching).
18. 1-VALVE REFLEX AND CRYSTAL DETECTOR, with 1-VALVE L.F. AMPLIFIER, Controlled by Switch.
19. H.F. DETECTOR AND L.F. (with Switch to Cut Out the Last Valve).
20. DETECTOR AND 2 L.F. AMPLIFIERS (with Switches for 1, 2 or 3 Valves).

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All orders for these Blue Prints should be sent direct to the "Popular Wireless" Queries Department, Fleetway House, Farringdon Street, E.C.4, enclosing a stamped addressed envelope and a postal order for 6d. for each Blue Print Ordered.



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I've made—
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COLOURED CONNECTING WIRE"

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2 ft. lengths

Per Packet 1/4 Assorted Colours

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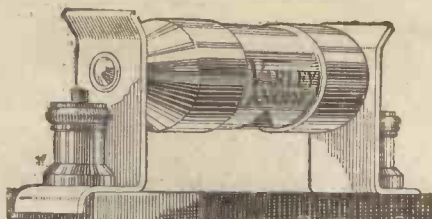
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Where Resistance Capacity is concerned—and this is the ideal form of intervalve coupling—the Varley has no equal.

Non-inductively wire wound on the famous Varley Bi-Duplex system, with turns silk separated, this resistance is absolutely constant under all atmospheric conditions, and ensures a wonderful purity of tone. A specialist's job—that's what the Varley is. A coil winding job, scientifically designed and constructed by experts who for 27 years have been engaged in every form of accurate and intricate coil winding.

If you value permanence and reliability insist on a Varley.

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60,000 ohms, 80,000 ohms, 100,000 ohms.

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Hole in Bush 0.04, 0.04, 2BA, 1/4", 5/16", 3/8", 7/16"
Price each... 1d. 1d. 1d. 1d. 2d. 2d. 2d.
Special sizes made to order at slight additional cost.

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"CROIX" TRANSFORMERS

Guaranteed genuine. 31 and 51.
CONTINENTAL SUPPLIES.
497, OLD FORD ROAD, LONDON, E.

EASY PAYMENTS Finest 2-valve amplifier set, including loud speaker, 120 H.T., D.E. valves, £7 10s.; or 18/9 down and 11 instalments of 15/-.

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L-speaker, hornless, £5 line for 55/-; Good Crystal Sets, 8/3 and 9/3; Amplifiers, 17/6 and 21/-; Phones, Telefunken type, 7/9; Dr. Nesper, 10/6; Fr. T. Hobson, 11/6; U.S. Baldwin, 17/9; Philips Valves, bright, 3/2; or D.E. 7/6; Radio Micro special, 5/9; or Power, 10/6. Good H.T. 60-v., 5/9, or 4-v. (laboratory test), 4/- doz. Nice metal case, 3/6. Accumulators, with 12 months' guarantee, 2-v. 40 ignition, 8/3; 4-v. 40, 15/-; 6-v. 60, 29/-. Polished Cabinets, Ebonite, Variometers, Transformers, Condensers, Coil Holders, and everything in Wireless reliable and cheap. Satisfaction or cash refunded.

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This is a REAL power valve—British Made—Radio Guaranteed—and far less money than other leading makes. From untied dealers or direct.

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The Editor will be pleased to consider articles and photographs dealing with all subjects appertaining to wireless work. The Editor cannot accept responsibility for manuscripts and photos. Every care will be taken to return MSS. not accepted for publication. A stamped and addressed envelope must be sent with every article. All inquiries concerning advertising rates, etc., to be addressed to the Sole Agents, Messrs. John H. Lile, Ltd., 4, Ludgate Circus, London, E.C.4.

As much of the information given in the columns of this paper concerns the most recent developments in the Radio world, some of the arrangements and specialities described may be the subject of Letters Patent, and the amateur and the trader would be well advised to obtain permission of the patentees to use the patents before doing so.

Readers' letters dealing with patent questions, if sent to the Editor, will be forwarded to our own patent advisers, where every facility and help will be afforded to readers. The envelope should be clearly marked "Patent Advice."

TECHNICAL QUERIES.

Letters should be addressed to: Technical Query Dept., "Popular Wireless," The Fleetway House, Farringdon Street, London, E.C.4.

They should be written on one side of the paper only, and MUST be accompanied by a stamped addressed envelope.

Queries should be asked in the form of the numbered questions: (1), (2), (3), etc., but may be accompanied by a short letter giving any necessary additional particulars as briefly as possible.

For every question asked a fee of 6d. should be enclosed. A copy of the numbered questions should be kept, so that the replies may be given under the numbers. (It is not possible to reproduce the question in the answer.)

BLUE PRINTS. A series of 20 Blue Prints can be obtained from the Query Dept., price 6d. per Blue Print.

Only a limited number of circuits are covered by this series, and full details of the circuit arrangements available in Blue-Print form are published fortnightly in the advertisement columns of this journal.

All other back-of-panel diagrams are specially drawn up to suit the requirements of individual readers at the following rates: Crystal Sets, 6d. One-Valve Sets, 6d. One-Valve and Crystal (Reflex), 1s. Two-Valve and Crystal (Reflex), 1s. Two-valve Sets, 1s. Three-Valve Sets, 1s. Three-Valve and Crystal (Reflex), 1s. 6d. Four-Valve Sets, 1s. 6d. Multi-Valve Sets (straight circuits), 1s. 6d. Except SUPER-HETERODYNE DIAGRAMS, all of which, irrespective of number of Valves used, are 2s. 6d.

If a panel lay-out or list of point-to-point connections is required, an additional fee of 1s. must be enclosed.

Wiring diagrams of commercial apparatus, such as sets of any particular manufacture, etc., cannot be supplied. (Such particulars can only be obtained from the makers.)

Readers may submit their own diagrams, etc., for correction or for criticism. The fee is 1/- per diagram, and these should be large, and as clear as possible.

No questions can be answered by phone. Remittances should be in the form of Postal Orders.

high resistance of the loud-speaker windings. The actual figures will be $\frac{2 \text{ volts}}{2,000 \text{ ohms}} = .001 \text{ amps.}$

This is only one milliamp, and is probably less current than the loud-speaker takes from the H.T. battery in the ordinary way.

The fact that the L.T. battery was of large capacity does not affect the issue, but that it could have gone on supplying the current for a very long time before the battery became exhausted is shown as follows:

Actual capacity of the half exhausted L.T. battery = 15 ampere-hours. Current flowing in the external circuit = .001 amp.

$\frac{15}{.001} = 15,000 \text{ hour's supply!}$

Your haste in disconnecting the battery was therefore quite unnecessary, as theoretically it would have been quite safe to leave it till the end of next year!

AN EFFICIENT AERIAL SYSTEM.

P. M. S. (London, S.W.19).—I am purchasing a 2-valve set (Det. and L.F.) with which I hope to get several distant stations besides London. What will be the best form of aerial to erect, and can I further assist DX (long-distance) reception by attention to the earth connection?

An aerial that is suitable for both local and distant reception is one of the single-wire type, 30 to 40 ft. in height and 70 to 80 ft. long, including the leading-in wire.

If possible, the far end—that is, the end farthest away from the house—should be higher than the leading-in end of the aerial.

The earth wire for best results must not be longer than 20 ft. and should either terminate on an earth tube driven into damp soil or else be connected to a main water pipe—one that goes direct into the ground.

(Continued on page 532.)

Questions and Answers

A SLOW DISCHARGE.

E. J. E. (Cranbrook Park, Ilford).—Owing to a misunderstanding, my 2-volt accumulator was connected to the loud-speaker terminals and left for some hours. Fortunately it was not left all night, and it seems to have been uninjured. How is it that with such a large current available (the accumulator has a capacity of 30 actual ampere-hours) no serious damage was done?

The loud speaker is of the 2,000 ohms resistance type, and is generally worked on a 3-valve set. On the face of it, I expected to find the loud-speaker windings burnt out by the large current or else the L.T. battery run down, as it was about half discharged at the time.

The current which flows in a case of this kind (direct current) is very easily calculated from Ohm's Law—i.e., Current (amps.) = $\frac{\text{E.M.F. (volts)}}{\text{Resistance (ohms)}}$

Applying this formula to your case, it will be seen that only a very small current will flow, owing to the

THE **H.M.H.** 18/6
PHONE

SPECIAL NOTICE

The closing date of this competition, which also appeared in this journal on May 8th, has, owing to the recent strike, been altered to June 19th, and Coupons from the earlier issue will also be accepted in connection with same, providing they reach us not later than June 19th, accompanied by P.O. covering the amount of entries submitted.

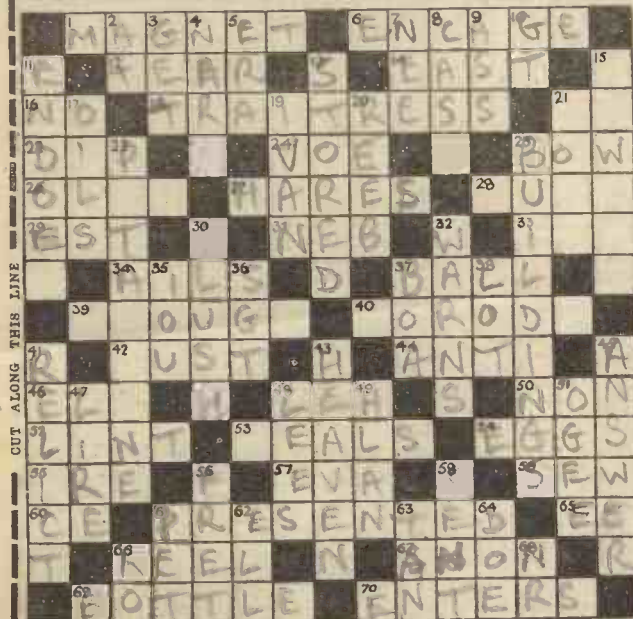
Wear the finest British Headphones AND WIN A SIX-VALVE DE-LUXE RECEIVING SET or a large cash prize.

In order to introduce to the public their wonderful new wireless invention, the makers of H.M.H. HEADPHONES offer three valuable prizes, together with 25 sets of Headphones as consolation prizes, for the best solutions received of the cross-word puzzle given below.

Members of the Staff of the Company will not be allowed to compete.

First Prize - - A Six-Valve De-Luxe Receiving Set, or £50 Cash
Second „ - - A Four-Valve „ „ „ £25 „
Third „ - - A Two-Valve „ „ „ £10 „
and 25 consolation prizes of a pair of H.M.H. Headphones.

This Competition is also appearing in two other leading Wireless Journals, and a sealed solution is in the keeping of the respective Editors.



YOU HAVE ONLY TO SOLVE THIS PUZZLE

CLUES ACROSS.

1. Pertaining to the lodestone.
2. Confine in a cage.
3. To draw asunder.
4. Where the sun rises.
5. Negative term.
6. One guilty of treason.
7. Denotes certain make of motor cycle.
8. To lower headlights.
9. A bay, or creek (Shetland).
10. Used for shooting arrows.
11. Furze, or gorse shrubs.
12. Four-footed animals.
13. A lump or ridge on metal.
14. Established (abst.).
15. The beak of a bird.
16. A girl's name.
17. Is unwell.
18. Anything round.
19. A soft bog or marsh.
20. An allowance or pension.
21. Loving desire.
22. (Prefix) meaning against.
23. A priest (ancient).
24. A meadow.
25. Negative term.

CLUES DOWN.

1. Used for dressing wounds.
2. Conceals.
3. Instigates.
4. Anger.
5. A girl's name.
6. Join together with a needle.
7. Church of England (abst.).
8. Offered as a gift.
9. Errors excepted (abst.).
10. Bottom of a ship.
11. Shortly.
12. A vessel for holding liquid.
13. Penetrates.
14. Lubricates.
15. First "Russian Emperor."
16. Beer (reversed).
17. Kind of motor car.
18. Pertaining to a metal.
19. Houses.
20. Flow of blood to the face.
21. Gives notice of danger.
22. Memorandum of debt.
23. Sergeant, abst. (army).
24. Ladies' neckwear.
25. A large quantity.
26. A widow.
27. Supreme happiness.
28. To reply to.
29. Italian coins.
30. Sediment.
31. A boy's name.
32. A wavelike moulding.
33. To irritate.
34. Despatched.
35. Fondle.
36. Measure of cloth.
37. Make brown.
38. Female animal.
39. Knock out (abst.).
40. Near (abst.).

RULES OF ENTRY.

1. Prizes are awarded strictly for the skill shown in the solving of this puzzle.
2. The first prize will be awarded to the competitor sending in the correct solution. Should more than one correct solution be received, prizes to the total value will be divided among the successful competitors.
3. Every purchaser of a pair of our H.M.H. Headphones (direct from us) will be entitled to 3 free entries in this competition. All other entries must be accompanied by P.O. for 1/-, made payable to H. Morser & Co. (Wireless) Ltd., and must be crossed " & Co."
4. Solutions must reach H. Morser & Co. (Wireless) Ltd., 67/68, Hatton Garden, London, E.C.1, not later than June 19th, 1926.
5. Solution and names and addresses of Prize-winners will appear in "Popular Wireless," July 3rd, 1926.
6. All prizes will be forwarded to successful competitors without delay.
7. No correspondence can be entered into, and the decision of the Directors of H. Morser & Co. (Wireless) Ltd. must be accepted as final and binding.

P.W. To H. MORSER & CO. (Wireless) Limited, 67/68, HATTON GARDEN, LONDON, E.C.1.

Dear Sirs,—I enclose P.O. value..... as Entrance Fee for the Enclosed Solutions.
(Please use Block Capitals, in ink.)

Name..... Address.....

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'Phone No.:
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Send 4d. Stamps.

ELECTRADIX RADIOS.

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Parrs Ad.

PLEASE be sure to mention **POPULAR WIRELESS** when communicating with Advertisers. **THANKS!**

WET H.T. BATTERIES.

British-made Glass jars, 21 by 13, for making up wet H.T. units (Leclanché), 1/- doz., or waxed to prevent creep, 1/3 doz. Post extra. Phones re-wound and re-magnetised, 4/6 per pair. The H.R.P. Co., 46, St. Mary's Road, Leyton, E.10.

HEADPHONES REPAIRED

Re-wound & re-magnetised 5/- per pair. Loud Speakers repaired 5/-. Transformers re-wound 5/- each. All work guaranteed and tested before delivery. Write for Trade Prices. Phone: Clerk. 1795. MASON & CO., 44, East Road, City Road, N.1.

LOSTROLOX
WIRELESS VALVES
THE ECONOMICAL COMBINATION
2v. '06 H.F. & L.F. each 9/-
2v. '34 P.V. 11/-
Obtainable from Lewis's Ltd.,
Liverpool and Manchester and
Lustrolux Ltd., West Bollington.
Nr. Macclesfield.

CHEAP GOVERNMENT WIRE!!

Saves for gardens, fencing, greenhouse, training peas, fruit. Waterproofed, flexible, lasting! Small lots quoted, or 1916 mile. Samples free with list. 300 bargains. Postcard to-day.

GREENS, 297, ALBERT, LYTHAM.

H.T. Accumulators—
60 Volts
3 Actual Amp-hour **37/6**



SOLD ON APPROVAL SYSTEM
Obtainable only from:
ACCUMULATORS ELITE,
31, Waterhouse Street, HALIFAX,
or from Messrs. CECIL POHLMAN, Ltd.,
77, Great Portland Street, London, W.1.
Trade Supplied Telephone 1304

ADVERTISEMENTS.

As far as possible all advertisements appearing in "P.W." are subjected to careful scrutiny before publication, but should any reader experience delay or difficulty in getting orders fulfilled, or should the goods supplied not be as advertised, information should be sent to the Advertisement Manager, "Popular Wireless," 4, Ludgate Circus, London, E.C.4.

RADIOTORIAL QUESTIONS & ANSWERS.

(Continued from page 530.)

EXCHANGING SETS.

J. N. E. (East Dulwich).—I have a two-valve set (H.F. and Det.) and am thinking of changing over to a three-valver for loud-speaker work. As I am not a "handy man" I should like to let the old set go in part payment for a new one. Is there any firm of wireless dealers who will take back the old set and make an allowance for it when a new one is purchased?

We believe that such terms are advertised by the Express Radio Service, Factory Square, Streatham, London, S.W.16.

HINTS ON TUNING.

F. L. E. (Weston-super-Mare).—I bought a 1-valve wireless set during the strike, and now I have become thoroughly interested in it, and should like to hear other stations beside the local one (Cardiff).

I am hopelessly puzzled by "tuning" and should greatly appreciate a few hints about this function of the set.

Probably a method of series and parallel aerial tuning is arranged on it, either by means of the "three terminal" method or by a D.P.D.T. switch. The coils will be: fixed (A.T.I.), moving (reaction). Suitable sizes for 2 L.O. and other B.B.C. stations and 5 X X will be as follows:

Main B.B.C. stations:

A.T.I. (series aerial tuning), 50-75.
A.T.I. (parallel aerial tuning), 35-50.
Reaction, 50-75.

5 X X and Radio-Paris:

A.T.I. (parallel aerial tuning), 200.
Reaction, 100-200.

Best results in every case will be obtained when the station is tuned on the variable condenser at approximately 90 degrees. If the station is received with all the condenser in—that is, at 180 degrees—it denotes that a coil one size larger is required.

Similarly, if a station is received with all capacity out, a smaller coil must be tried.

Should the variable condenser be in the series position with all capacity out (0 degrees), parallel aerial tuning can often be tried to advantage, and this will probably save you the necessity of changing the coil (A.T.I.).

It may be necessary to bring the set to the point of oscillation to bring in distant stations, and the careful choice of a coil for reaction will help in this direction.

If possible, try and use as small a coil as possible. Control is best when oscillation takes place when the reaction coil is at approximately 45 degrees to the A.T.I. (aerial coil).

A fixed condenser of .001 to .002 placed across the phone terminals will assist in this respect and also help to "keep down" the size of the reaction coil.

Should the set not oscillate, we advise you to try the effect of reversing the leads to this coil. If, however, it still does not do so, more H.T. and a larger coil can be tried.

When a station is picked up (by rotating the variable condenser slowly) its carrier wave is first heard. This can be "resolved" by opening out the reaction until the silent point is reached, when speech will be heard.

It may then be necessary to slightly retune on the condenser, as any alteration of the reaction coil causes a slight loss (or gain) in wave-length.

It would be a good plan to get in touch with your local radio society. You can learn far more by discussion than by merely reading about wireless.

THEORY OF WIRELESS.

B. E. M. (Radlett).—Having graduated from a crystal to a two-valve set, I have become very interested in the theory of wireless. Can you recommend me a good text-book dealing with the action of electric currents, and explaining such phenomena as rectification, inductive coupling, etc.?

The best book for your purpose is that issued by the Admiralty, for the instruction of officers and men of H.M. Fleet. It is called the "Admiralty Handbook of Wireless Telegraphy," and is published by H.M. Stationery Office. Copies can be obtained through any bookseller, or direct from H.M. Stationery Office, Adastral House, Kingsway, W.C.2, price 5s. net.

CORRESPONDENCE. (Continued from p. 524)

SUITABLE DETECTOR VALVES.

[We have had a number of queries regarding the use of H.F. or L.F. Ediswan valves as detectors, and the following letter from the makers should be of interest to readers.]

The Editor, POPULAR WIRELESS.

Dear Sir.—We thank you for your letter of the 20th ult., in regard to the most suitable type of valves of our manufacture for use as detectors.

From our own extensive testing, we have found that in circuits of the Hartley or Reinartz type, the L.F. Valves are much to be preferred to the H.F., owing to the fact that they oscillate more freely than the latter, whereas in straight circuits they are also slightly better although the difference is not very marked.

From these findings we have advocated the use of the L.F. type as detector, and we feel that we are advising Ediswan users, as a whole, correctly and to their advantage.

Yours faithfully,

For the Edison Swan Electric Co., Ltd.,

J. THOMAS.

Joint Sales Manager.

123-5, Queen Victoria St.,
London, E.C.4.

For the Constructor DRILLING & TAPPING SIZES.

B.A.			WHITWORTH.		
Size.	For Tapping	For Clearance	Size.	For Tapping	For Clearance
0	11	6	$\frac{1}{16}$	$\frac{3}{64}$	52
1	17	10	$\frac{3}{32}$	$\frac{5}{64}$	41
2	25	12	$\frac{1}{8}$	$\frac{3}{32}$	30
3	29	20	$\frac{5}{32}$	$\frac{1}{8}$	4m/m
4	33	27	$\frac{3}{16}$	$\frac{9}{64}$	12
5	39	30	$\frac{7}{32}$	$\frac{11}{64}$	2
6	43	34	$\frac{1}{2}$	$\frac{1}{8}$	6½m/m
7	47	39	$\frac{5}{16}$	$\frac{19}{64}$	8m/m
8	50	44	$\frac{3}{8}$	$\frac{23}{64}$	10m/m
			$\frac{7}{16}$	$\frac{27}{64}$	11½m/m
			$\frac{1}{2}$	$\frac{13}{32}$	31

RESISTANCE COUPLING.

The Editor, POPULAR WIRELESS.

Dear Sir.—May I reply to Mr. Honri's letter in regard to Resistance Coupling ("P.W." No. 202)?

Contrary entirely to Mr. Honri's presumption, the use of high anode resistances and leaks and small condensers does not render the receiver complicated or difficult to handle. The circuit, with the exception of the grid bias, is absolutely identical to the present popular and inefficient method.

It is not necessary to use special valves, although this is the ultimate aim.

Even using ordinary valves, the degree of amplification is much higher than by the present arrangement, the filaments of the valves, run at about half normal temperature, are practically everlasting, the cost of the condensers and anode resistances is considerably reduced; there is straight line amplification of a nature hitherto unobtainable—in fact, the advantages are perfectly obvious, and, moreover, directly contrary to what Mr. Honri states, the "greenest" amateur can use the set.

The remark re the Super-Het. is rather timely, since this is a line of experiment which one member of our society is already following, substituting the transformer method (ugh!) by the high amplification obtainable by the improved B.C.

In regard to the special values Mr. Honri mentions, I believe he must be mistaken. This method has been very carefully experimented upon by two German scientists, Von Ardenne and Hehnert, who, according to their recent work, "hope to construct valves having an amp. factor of 701." The rights in Germany are held by the Loewe Audion Firm, Berlin (hats off to them!), but even these gentlemen do not hope to obtain valves having amp. factors of 80/90—at least, not yet.

The outcome of what I have said is: it is simple to handle, less costly to make run, and infinitely better.

Yours faithfully,

R. G. TURNER,

(Chairman Northampton and District Radio Society).
4, Derby Road,
Northampton.

A "P.W." TWO-VALVE L.F. AMPLIFIER.

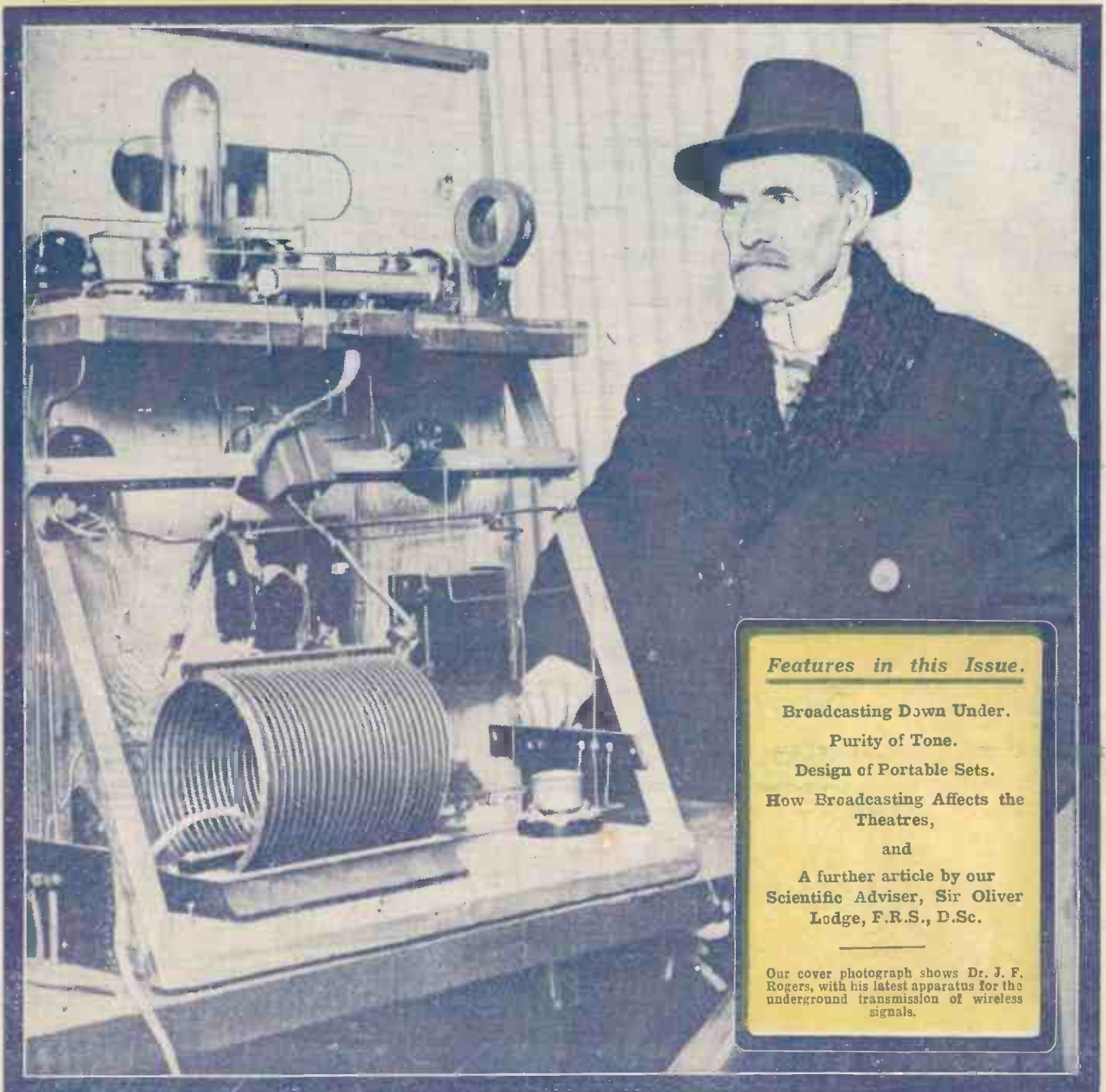
Popular Wireless

Every Thursday
PRICE
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and Wireless Review
Scientific Adviser: SIR OLIVER LODGE, F.R.S. D.Sc.

June 12th, 1926.



Features in this Issue.

Broadcasting Down Under.

Purity of Tone.

Design of Portable Sets.

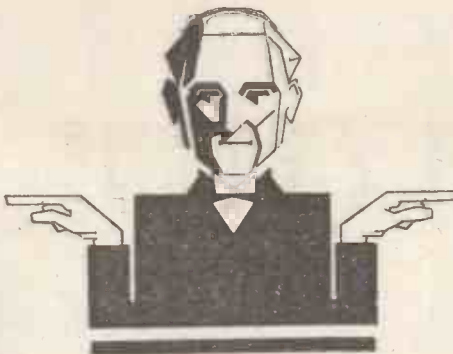
How Broadcasting Affects the
Theatres,
and

A further article by our
Scientific Adviser, Sir Oliver
Lodge, F.R.S., D.Sc.

Our cover photograph shows Dr. J. F.
Rogers, with his latest apparatus for the
underground transmission of wireless
signals.



WHAT IS THIS ?



WHAT IS THAT ?

**Buy the one -
and win the other !**

The Dubilicon is a multiple condenser containing eight separate units, the terminals of each unit being brought out to sockets on the lid. By using Clix plugs (made by Messrs. Autoveyors, Ltd., 84, Victoria Street, S.W.1) of which two are given with every Dubilicon, the units can be connected in a variety of series, parallel, and combined series-parallel arrangements giving a very large number of different capacities ranging from zero up to 0.011 μ F.

The Dubilicon, therefore, is of incalculable value to the experimenter who wants to find the best value of fixed capacity for any part of his circuit.

Every purchaser of a Dubilicon is entitled to enter for the £200 competition. All you have to do is to buy your Dubilicon from a Wireless dealer, and find out the total number of different capacities you can get by using the first five units. Full instructions are given with every Dubilicon sold.

Get one to-day !

**THE PRICE OF A DUBILICON IS 30/- ---
AND THE PRIZE IS £200 !**

REGISTERED  TRADE MARK

DUBILIER
CONDENSER CO (1925) LTD

ADVERT. OF THE DUBILIER CONDENSER CO. (1925) LTD., DUCON WORKS,
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The NATURAL TONE

Loud Speaker



THE
RADIOLUX AMPLION

Prices £4 : 15 : 0—£13 : 13 : 0

Other Amplion Models from 38/-

There is no substitute for a genuine AMPLION

Announcement of Alfred Graham & Co. (E. A. Graham), St. Andrew's Works, Crofton Park, London, S.E.4

The Chinese have a proverb which says—

“One picture is worth more than ten thousand words”



TYPES AND PRICES:

RED TOP. For H.F. use
1'8 volts 1 amp. 15/6

PLAIN TOP. For Detector
1'8 volts 1 amp. 15/6

The new Cossor Stentor Two

GREEN TOP. Power Valve
1'8 volts 15 amp. 18/6



Made
Under
Cossor Patents

—therefore

EXAMINE closely this illustration of the new Cossor Point One. Observe particularly the seonite insulator at the top of the Anode—the key to the successful solution of the old problem of truly Co-axial Mounting. Week by week we shall unfold the story of this—one of the most remarkable contributions yet made to the Science of Radio.

The new COSSOR Point One

Popular Wireless

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RADIO NOTES AND NEWS.

Sir Oliver Lodge—A Fine Feat—The Longest Listener?—The Nightingale in Prague—World's Highest Aerial.

Sir Oliver Lodge.

I AM sure all readers will wish to join me in birthday greetings to Sir Oliver Lodge. The "Father of British Wireless," as he has been called, was born at Penkhal, Staffs, on June 12th, 1851, and his distinguished work in various spheres of thought and action has won for him the national esteem, admiration, and—to a remarkable degree—affection.

When Sir Oliver enters his seventy-sixth year on Saturday, he will have a host of congratulations from famous people, and also the good wishes of many thousands of unknown listeners who have benefited from his researches.

Another Birthday.

WRITING of birthdays reminds me that POPULAR WIRELESS has just entered its fifth year. Yes, it was on June 2nd, 1922, that the little blue-and-yellow stranger first appeared upon the book-stalls, receiving a hearty welcome, which has lasted with a bang right up to this present moment of grace. And what a time it's been, hasn't it?

Not This Week!

DO you remember the good old days, right away back in '22 and '23? Before dull emitters had come into their own, and when not one handful of hair had been pulled from human head during super-het. fault-tracing? Can you recall the frightful and dizzy prices we used to pay for components? (Wherever did we get the boodle from to do it?) Four years! What a time it's been, to be sure! And the best of it is, that sets may come, and valves may go, but the ether goes on for ever. (Some day H.T. batteries will go on for ever, too—but not this week!)

Labour Lectures on the Air.

THE International Federation of Trade Unions announce that a broadcasting station is being erected by the

Chicago Federation of Labour. Permission has been obtained from the City Council to put it up at the municipal pier, and from here the anti-Labour propaganda of rival newspapers will be combated by the microphone.

A Fine Feat.

WHAT is believed to be the first Ireland-India telephone chat was accomplished recently from the station of Mr. E. Megaw, 3, Fortwilliam Drive.



The small studio at 2 L O from which news and weather reports are broadcast.

Belfast (GI-6 M U). He succeeded in getting into touch with Kohat, India, about half-past nine one night, using a Mullard valve, with plain grid modulation.

They said it was coming through "quite clear" and "fairly strong" at Kohat! My Hat!

The Longest Listener in the Land?

A WRITER in the "Nottingham Evening Post" has discovered a whale of a listener, who is so enthusiastic that

for six months he never missed a single item from the local station! It is getting on for two years since he owned his first crystal set, and his average listening-time is approximately seven hours per day. Gramophone records, children's hours, weather forecasts—he doesn't care what it is, but if it's on the air he's on its track. Can anyone beat this Nottingham prodigy?

"Oh, Happy Band . . ."

AN orchestra four thousand strong will be before the Crystal microphone on June 19th, in a relay from the Crystal Palace. This Brobdingnagian band will be the combined effort of the National Union of School Orchestras, and if the young rascals don't lift the roof of the Crystal Palace right off, it won't be their fault!

£7 2s. Instead of 10s.

GEORGE COULTHARD, of St. Andrew's Road, Willesden Green, was recently fined £5, and £2 2s. costs, for installing and working an unlicensed wireless set.

The Willesden magistrate remarked that a wireless licence for ten shillings a year was "the world's best value."

Ford Motors for Valve Making

BEFORE we forget all about the late general strike, one little wireless tit-bit deserves special mention. As soon as the trouble threatened the Cossor people rushed out and bought up four old Ford vans.

Ten pounds each they cost, and though not handsome in appearance, their engines were a credit to Henry Ford. Within one hour of arrival at the works, each engine had been cut out from its chassis, and then all four were mounted at strategic points in the building, ready to drive the dynamos.

So if the strike had lasted a bit longer we should have had semi-Ford valves going—and I'll bet they would have "wandered"

(Continued on next page.)

NOTES AND NEWS.

(Continued from previous page.)

over hill and dale just as readily as their four-wheeled brethren do.

A Famous Broadcast.

"WHAT was the exact date and what wave-length was used, on the historic occasion of Dame Melba's first broadcast?" asks a correspondent.

The date was June 15th, 1920, and if I remember rightly the wave-length was 2,800 metres. The Chelmsford programme crossed the Channel so well that the operators in the Eiffel Tower, Paris, made a good phonograph record of Melba's "Home, Sweet Home."

Shakespearean Soliloquy.

BROADCASTING in Denmark has now been taken over by the Government, and their first act has been to start an intensive campaign against pirates. The official offensive appears to be meeting with marked success, for the number of licences issued has very nearly trebled itself in the last two or three months!

Which just goes to show that an otherwise honest man may listen and listen, and yet not bother to buy himself a licence—"at least, 'tis so in Denmark," as Hamlet would have said!

'Phones Out of Fashion.

ACCORDING to a recent census, it has been proved beyond doubt that ninety-one per cent of the radio listeners of Milwaukee use loud speakers.

And human nature being what it is, there is no doubt that the remaining nine per cent habitually break the Tenth Commandment!

B.B.C. and the Honours List.

WHEN the list of birthday honours is published this year, it is likely to contain at least one name that will be well-known to every listener who is interested in the B.B.C. personnel. On account of the strike, the announcement, which is usually made in June, has been postponed to July.

The Nightingale in Prague.

LISTENERS who have had the pleasure of picking up Prague, will be glad to know that they over there are just as pleased when they hear British broadcasting. Here is an extract from a letter to "The Times," written by Dr. Antusch Adolph, Prague V, 98, Czechoslovakia.

"By chance I was listening to the London concert, using an ordinary three-valve set. You can imagine our surprise and joy to hear for the first time the song of the nightingale. This wonderful event will be an everlasting impression for my whole life. Many thanks to the B.B.C."

New Belfast Transmitter.

THE City of Belfast Y.M.C.A. Radio Club has just received licence to transmit upon 23, 45, and 150-200 metres. The call sign allotted is G 1-6 Y M, and transmissions will very shortly be on the air. Reports will be welcomed, and those desirous of further particulars should write to the Hon. Sec., John J. Cowley, Esq., Y.M.C.A. Radio Club, Wellington Place, Belfast.

Too Optimistic.

"HAS a new valve been invented which requires no batteries?" inquires a correspondent, who has been puzzled by an advertisement which he has seen. It depicts a four-valve set, which it is stated will "function without batteries." No particulars of the method are given, but presumably it simply works from the electric light mains instead!

There may be no intention to deceive, but as it stands the advertisement is too optimistic, and might prove very misleading, so readers are advised to get further particulars before "parting-up."

Commercial Candour?

LOOKING through some wireless trade items the other day I saw an announcement that two companies had been formed in Italy, one with a capital of half a million *liras*, the other with 400,000 *liras*.

Is this commercial candour or merely a misprint?

SHORT WAVES.

"The only woman who can be sure her husband really works when he says he does, is the wife of the radio announcer. And even she can't tell what he's up to while a selection is being broadcast."—*Popular Radio*.

2 L Quagmires.

"Some things the B.B.C. does well. There are differences of opinion about its programmes. Many listeners find their reason tottering at the contents of some of the talks. They do not want to know why shrimps off the coast of Devon are more courteous to their wives than any other shrimps are—or anything of that odd sort. Some people dislike jazz; some want all jazz music. But there is unanimity on one matter: the B.B.C. editorials are a bore and should be stopped."—*Evening News*.

Horse (looking at farmer with set of radio carphones on): "Well, of all the crazy harness, that's the damndest I ever saw!"—*Life*.

Korea Calling.

THE latest country to be converted to broadcasting is Korea. A powerful transmitter is now in course of erection at Seoul, and it is hoped that the programmes will be on the air next month.

The Searchlight Tattoo.

THE B.B.C. announce that the relaying of the Aldershot Command Searchlight Tattoo has been fixed for Tuesday, June 15th. The special feature of the actual display this year will be the Pyramid of Searchlights, but probably the best thrill for listeners will be the item called the Entry of the Massed Bands.

World's Highest Aerial.

THE German Ministry of Posts and Telegraphs is going to have the tallest aerial in the whole wide world! A radio tower is to be erected at Königs-wusterhausen, Berlin, with an aluminium tower 828 ft. above the ground. On top of this will be a mast 58 ft. high, which is going to be just about a couple of feet higher than the Eiffel Tower arrangement.

Cutting the Cackle.

WHATEVER the weather may be doing at the precise moment you happen to read these words, there is no doubt whatever that theoretically (according to Negretti and Zambra, the "Nautical Almanack," "Old Moore," and all the other authorities) it ought to be summer-y. So

the B.B.C. is arranging to cut out most of the talks, and give us instead something a little less stodgy.

The 9.40 talks will be shortened and brightened, and the 7.40 lectures will be optional to each station. Light music will be the order of the day, and those announcers who will say "pi-ah-no-forty" instead of "piano" are looking forward to plenty of good practice.

Unnecessary Interference.

AREN'T some of the amateur transmitters going a bit too strong nowadays? Several complaints have reached me lately about Morse transmissions during broadcasting hours, and there has been some talk of short-wave telephony butting in on B.B.C. programmes in certain districts.

One North London station is getting itself thoroughly detested by listeners, who can't cut it out and hear the programmes they are paying for: What about it, hams?

Over Two Million.

DID you notice, the P.M.G.'s recent announcement that the number of wireless licences issued on May 1st was 2,012,000? Pretty good—what? At ten bob each, between us we have scooped up well over a million pounds for the national exchequer. Add to this the money we spend on accumulator charging, new gadgets, doo-hickeys, whatnots, and other components, and the average listener begins to look a bit of a financial hero, don't you think?

Transmitter for Vatican.

ACCORDING to the "Universe and Catholic Weekly," a wireless transmitting station is to be installed at the Vatican this month. It is the gift of the American inventor, Mr. John Hays Hammond, and is to be placed in the Observatory, where a room has been specially set aside for it.

Sea Lions Calling.

THE "Wireless Pram," a specially designed transmitter on wheels, which has previously been used for broadcasting programmes from the Zoo, will be in use again on Saturday (June 12th).

Starting about 5.15, and lasting approximately three-quarters of an hour, it is hoped this programme will give listeners the opportunity of hearing the noises of the sea lions at the London Zoological Gardens.

The Memory Man.

AN interesting forthcoming broadcast, that was postponed owing to the strike, is that of Datas, the famous memory-man.

He is due to appear before the microphone at 2 L O on June 17th.

Billy Bennett's Broadcast.

LISTENERS who enjoyed the comic-alities of Billy Bennett, on the occasion of the recent command performance, are disappointed that the B.B.C. did not fix up for a studio performance. £15 was offered for a 15 or 20-minute turn, but Mr. Bennett—who was starting for a world-tour almost immediately—considered this remuneration inadequate, so the idea was abandoned.

ARIEL.



Purity of Tone

Mr. Honri's articles in "P.W." have attracted widespread attention among all classes of amateurs and the following contribution from his pen, will, we feel sure, create just as much interest as before.

THE expression "purity of tone" is one of my pet aversions. To me it conveys the meaning "pure tone"—i.e. pure audible note—i.e. an audible frequency without harmonics. Turning to the pages of Webster, I find that among other things he defines the word "pure" as "freedom from all heterogeneous or extraneous matter."

A tuning fork has very nearly a pure tone, and a fork tuned apparently to middle C of the piano has an unsullied frequency of about 250 vibrations per second. Middle C of the piano itself is not "pure," however good the piano is, and if that note was without its harmonics (i.e. if it had "pure tone") it would surely sound exactly the same as the tuning fork. More extraordinary still is the fact that the middle C of the piano can be recognised by its harmonics alone and with the fundamental 250 cycle note suppressed. These impurities or relative strengths of harmonics give the piano its characteristic tone. Very fine differences in the harmonic strengths enable the expert ear to detect the make of a piano without seeing it.

All this talk about "purity" may seem to have little to do with radio; yet I feel sure that many readers will have been persuaded by eloquent salesmen that So-and-so's loud speaker has a very "pure tone." Perhaps the salesmen mean that the loud speaker reproduces *exactly* every note as sung or played at the studio without the addition of any local harmonics. If he really means this, then he is selling the *perfect* loud speaker working off the *perfect* receiver. Or perhaps his enthusiasm can be put down to the correspondence college's number nine "sales talk" which he has been swarming up the night before.

Mechanical Rattle.

Resonances on some loud speakers tend to magnify very greatly the minute harmonics of lower notes to such an extent as to make the harmonics appear to be local additions. The loud speaker, after a vigorous middle age, grows old at the low notes and returns to the shrill notes of its second harmonics—I mean childhood. Mechanical rattle on a paper diaphragm loud speaker

is often due to reed or driving rod resonance and is usually heard on one frequency only. This may often be cured by accurately centering the driving rod which operates the diaphragm or slipping a tyre valve rubber over the rod. A moist atmosphere affects paper diaphragm loud speakers, especially those of the pleated variety. A periodical drying not too near a fire will do no harm and will sometimes eliminate an annoying rattle. Actual mechanical resonance on horn loud speakers rarely develops, and can usually be detected at the first trial of a loud speaker.

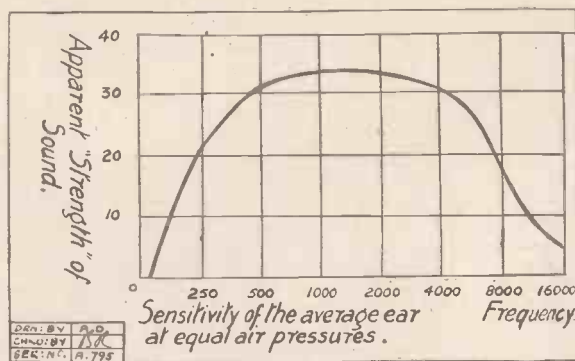
Tremendous Range of Frequencies.

The design of a loud-speaker horn which does not give some sort of megaphone effect is very difficult, and a horn which will really do justice to the extreme low fre-

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quencies will have to be six or seven feet long, opening out according to a definite law. The effect of using a long tube as a loud-speaker horn is to produce a series of resonances which give it a characteristic tone. You can recognise this characteristic "chinky" tone when you hear someone talking at the other end of a domestic speaking tube or a drainpipe. This gives an exaggerated idea of the type of distortion encountered in loud-speaker horns.

Let us consider the work the loud speaker has to do. The general effect of an orchestra or an organ on the human ear is to give an equal brain impression for every note on the musical scale. Owing to the fact that the ear is much less sensitive to the extreme low notes, very much more air pressure is required on these low notes to give "equal

audibility." That is why the pedal note pipes of an organ are so much larger physically than the higher note pipes. It would be extremely painful to listen to an organ which expended as much energy on its high notes as it did on its low droning notes. The sensitivity of the human ear is by no means constant over the range of audible frequencies with different persons; but all human ears become more and more insensitive from two hundred down to twenty-five cycles, which is about the lower limit of audibility. Then again, the older we get, the less of the higher frequencies we hear; and there are many sounds above our audibility range which dogs and other animals can hear. Parrots appear to hear the low audible frequencies very strongly, judging by the way they are disturbed by the roar of a distant aeroplane which humans can barely hear. Dogs are awakened by the catlike tread of Gilbertian burglars. The perfect broadcasting microphone

gives an equal voltage on the broadcasting station's modulator valves for equal air pressures on all audible frequencies. The perfect loud speaker gives equal air pressures on all frequencies for equal voltages on the transmitter, and, of course, subsequent equal voltages on the receiver. It follows from this that all amplifiers at both the transmitting and receiving ends should have a "straight line" amplification characteristic for all frequencies, and that much higher voltages will be set up on all the valve grids

Resonance of the Reed.

when the extreme low notes are transmitted. The "strength" of a broadcasting station depends largely on its capacity to deal with these low notes. If the low notes are neglected, transmitter control strength may be brought up considerably—which perhaps accounts for the extraordinary strength of certain foreign stations compared with our own!

The loud speaker has therefore to deal with a large column of air at the low frequencies in order to give the ear an adequate impression at these frequencies. With a horn type loud speaker this may be done by fitting a very large trumpet. The recent great steps in gramophone record repro-

(Continued on next page.)

BUILDING A COMPLETE LOUD SPEAKER AT MINIMUM COST.

By R. G. DAVIES.

THE chief advantages of the loud speaker about to be described are simplicity and cheapness of construction, combined with really good results, the only materials required being a few pieces of wood, one piece of paper and cardboard, an angle bracket, and a loud-speaking unit with reed attachment.



Fig. 1. The completed instrument.

The unit used in the present case is a "Lissen," which, together with reed attachment, costs 14s. 6d., and the complete loud speaker is shown in Figs. 1 and 4.

The making up is quite simple, as the radial arms, frames, etc., usually required to hold the diaphragm in position are dispensed with in this particular loud speaker.

Fixing the Diaphragm.

Cut from a piece of stiff drawing-paper a circle measuring 12 in. in diameter, and mark out a space of $1\frac{1}{2}$ in. on the outside of the circle, and draw two lines to meet at the centre, as shown in Fig. 2. Cut up line at A, and also up dotted line parallel to line B, which leaves a lap about $\frac{1}{2}$ in. wide for joining up. Glue this lap, and then draw the paper together so that line A comes flush with line B, and the result will be a cone with a depth of about 2 in.

Next mark out a ring on a piece of stiff cardboard, with an outside diameter of $13\frac{1}{2}$ in. and an inside diameter of $10\frac{3}{4}$ in., and cut this out with a sharp penknife. Take the paper cone and glue round the outside edge on the hollow side to a depth of about $\frac{1}{2}$ in.; lay the cardboard ring flat on the table and fix the cone to this. At the same time press gently on the point of the cone to ensure getting it evenly spread out all round. When this is properly fixed give the whole a coat of spirit varnish, which will make it damp-proof and more solid all round.

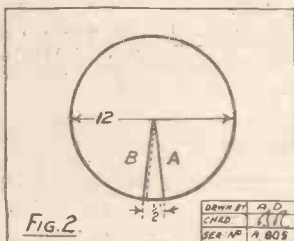
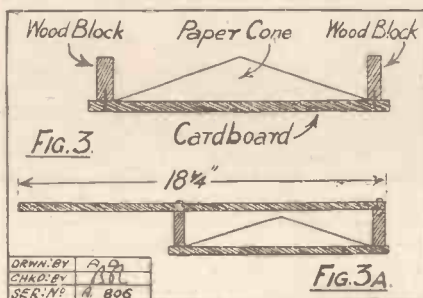


Fig. 2.

Fix two blocks of wood, measuring $2\frac{1}{2}$ by 2 by $\frac{3}{4}$ in. thick, opposite to each other by nailing through the cardboard ring with large-headed nails, as shown in Fig. 3. Take a strip of wood, measuring $18\frac{1}{2}$ by 2 by $\frac{3}{4}$ in. thick, and place this with one end flush with one wood block, the other end projecting over the other block, as shown in Fig. 3a.

Drill a hole in this strip exactly over the centre of cone, just large enough to take the flange of the Lissen unit as a tight fit. Afterwards screw the strip of wood in position, taking care that the hole is exactly over the centre of the paper cone.



It is only necessary now to mount the assembly in an upright position on another strip of wood with an angle bracket, which will be quite clear from reference to photographs. When this has been done, fix the Lissen unit tightly in position, the reed going through the centre of the cone, and fix firmly to the cone with the two nuts provided.

Good Volume Obtained.

It is advisable to use some washers between the nuts, so that the paper will not get damaged when tightening up. It will need some little experiment to find the best position in which to finally tighten up the nuts, as the tension on the diaphragm can be varied by the position of the nuts on the screwed rod of the reed. A fairly large fixed condenser is necessary across the terminals, the writer using one of .01 capacity.

When completed the speaker gives a quite good volume; but, of course, not so great as from a speaker with a large horn.

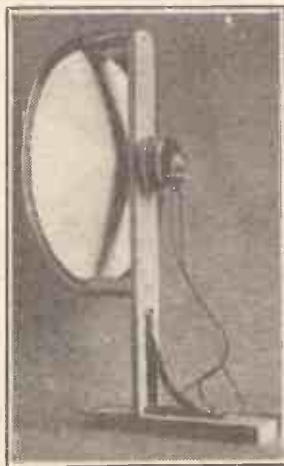


Fig. 4. Another view of the loud speaker.

PURITY OF TONE.

(Continued from previous page.)

duction have been due to the careful design of long tapering horns in the "hornless" machines. Surely nobody expects a "baby" loud speaker with a nine-inch horn to accurately reproduce the boom of the tympani and the double-bass! There are, in fact, so many difficulties to contend with in the design of a practical horn loud speaker for the home that many designers scrap the idea of a horn altogether. Several types of cone and paper diaphragm loud speakers are now on the market, and, on the whole, they are an improvement on the horn type.

Cone loud speakers operated on the reed or moving iron principle usually have a high resonance due to the natural frequency of the reed or driving rod. If the cone is held firmly at the edges there will be a natural resonance of the cone itself, the frequency of which depends on the size of the cone.

This cone resonance is a useful fault if it is between fifty and a hundred cycles, where it will bring in some valuable additional bass. It will also to some extent balance the reed resonance and result in a fairly even response over the entire musical range.

Electrostatic Principle.

The reed or moving iron with its resonance may be cut out by using a moving coil drive for the cone. A coil floating in a strong magnetic field is fixed to the centre of the cone in such a way as to operate it as a piston when audible frequency currents are passed through the coil. The difficulty with this system is that the magnetic field has to be so strong as to necessitate the use of an electromagnet and a heavy polarising current.

Another type is the "electrostatic" loud speaker, which is really a very large type of two-plate condenser. One of the plates of the condenser should be thin and movable and the other stationary, so that if the "charging" of the condenser is varied at audible frequencies, the varying "strains" on the plate will be musical as well as electrical.

The movable plate cannot very well float in mid air and it is necessary for it to be clamped at the edges to hold it in position. This clamping at the edges is the "snag" with the condenser loud speaker, for it means that the thin or movable plate will have a natural frequency. Most loud speakers of this type are very high toned owing to this fault.

The Perfect Loud Speaker.

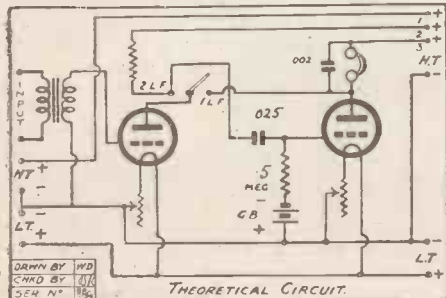
The perfect loud speaker will soon be with us, judging by the progress of loud speaker development during the last few months. When it does arrive it will only sound better than existing loud speakers when it is operated on a really perfect receiving set. Even if your present loud speaker doesn't do justice to the low notes, there is no harm in having them there and so preparing the road for the perfect loud speaker. A racing car is of little use on a cart track.



DURING the recent strike there must have been thousands of people who listened to broadcasting upon a set of their own for the first time. Probably it was a crystal set, or a one-valve set, and whilst reception upon the headphones may have been completely satisfactory in the circumstances, there is now a demand for loud-speaker reception instead.

Purity of Tone.

In many cases, one drawback to the use of a loud speaker is the mistaken impression that the quality of the reproduction will necessarily suffer. The old idea still prevails that in order to develop sufficient power to fill a room comfortably, the music must necessarily be distorted, or the voice sound harsh and raucous.



Whatever may have been the case a few years ago, when the art of broadcasting was in its infancy, this is certainly not true of radio reproduction to-day. Within the past year or so, great advances have been made in attaining clarity and a faithful rendering of the sounds in the studio.

LIST OF COMPONENTS.

	s.	d.
1 Panel 8 x 8 x 1/4 in. (Peto-Scott)	4	0
1 Box to fit 4 1/2 in. deep (Caxton Wood Turnery Co.)	7	3
16 Terminals	1	4
1 L.F. transformer (4 or 5 to 1 ratio) (Ward & Goldstone)	17	6
2 Valve holders (Peto-Scott)	1	0
2 Filament Resistances (Lissen "Major")	15	0
1 S.P.D.T. switch (Peto-Scott)	1	6
1 Grid leak (.5 megohm) (Mullard)	2	6
1 Fixed condenser (.025) (T.C.C.)	2	6
1 .002 fixed condenser (Lissen)	2	6
1 Anode resistance (Mullard)	2	6
Screws, Transfers, etc.		

The Amplifier Designed and Described by
P. R. BIRD.

(Assistant Technical Editor.)

Constructional work by
The "P.W." Constructional Staff.

Amongst the causes which contributed to the improvements effected, one of the most notable is the use of resistance-capacity coupling between the L.F. amplifying valves. This method has the great advantage of purity of tone and that indefinable "softness" and freedom from metallic clangour which was such an objectionable feature of an old-fashioned loud speaker set. Quite apart from this now popular method of coupling the valves, there has been a great improvement in all radio accessories and components, so that even if the old-fashioned methods of coupling are employed there is no necessity for distortion or harshness.

The set now to be described is an L.F. amplifier, by means of which good loud-speaker signals can be obtained in conjunction with the ordinary detector set (either crystal or straight one-valver), which unaided is only capable of giving headphone reception. The amplifier employs two valves, and a full list of components required to build the set is given upon this page.

From this it will be seen that no unusual or "stunt" components are employed, but all the parts are of standard design. The photographs show the appearance of the completed set, and as it is perfectly straightforward in construction, the amplifier is one which even a novice can build without much difficulty.

Transformer and Resistance Coupling.

It happens that this particular receiver was included in the famous "P.W." Sixpenny Blue Print Series, so that if he desires, the constructor may purchase the blue print through the Query Dept. (See "Radiatorial" announcement). Upon the blue print will be found enlarged wiring and theoretical diagrams; and in addition there

is a pictorial lay-out showing how the various components are arranged.

It has already been stated that great purity of reproduction is possible when using resistance-coupled stages of L.F. amplification. There is, however, one disadvantage in this method. It does not give the same high degree of amplification per valve as transformer-coupling, and it is not always easy to use the method in conjunction with a crystal set unless an excessive number of valves is employed.



The complete amplifier ready for connecting up.

For this reason the first valve of this amplifier is coupled to the detector by means of an L.F. transformer, and the subsequent amplification is carried out by the resistance capacity method.

A single-pole-double-throw switch in the centre of the panel allows either one or both of the amplifying stages to be switched in, so that a wide range of amplification can be obtained.

The theoretical diagram, reproduced upon this page, shows that, apart from the switch mentioned, the circuit is of the simplest possible description. The signal impulses received from the detector—either crystal

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A "P.W." TWO-VALVE AMPLIFIER.

(Continued from previous page.)

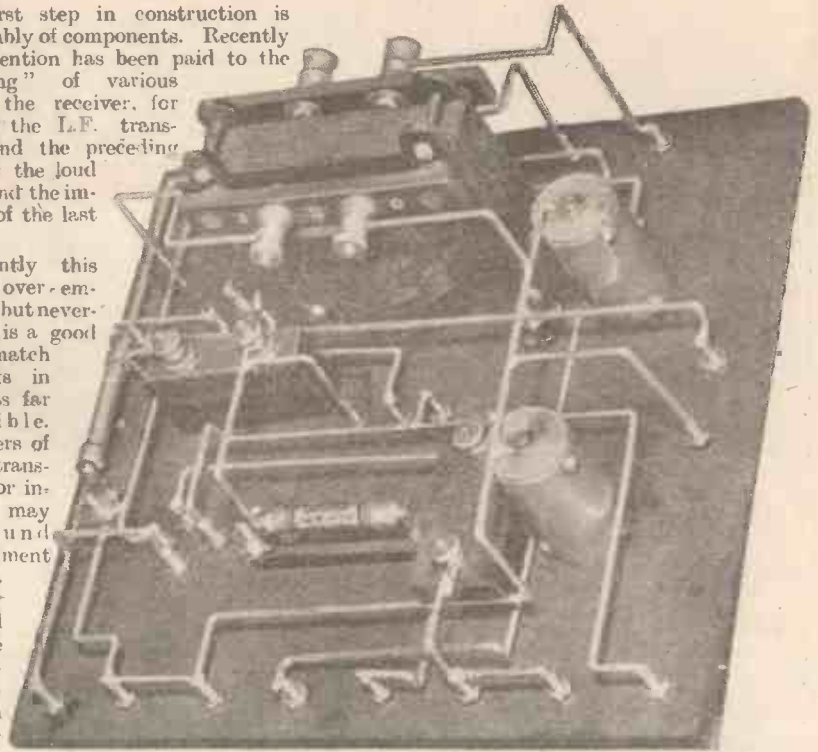
or valve—are passed through the input terminals to the primary winding of the L.F. transformer. Reappearing at the ends of the secondary winding, they are impressed across the grid and filament of the first L.F. amplifying valve. Similar but magnified signals can then be heard in the plate circuit of this valve, if the switch is in the "one L.F." position, when the telephones will be in series with the plate of the valve and H.T. plus 3.

The Switching.

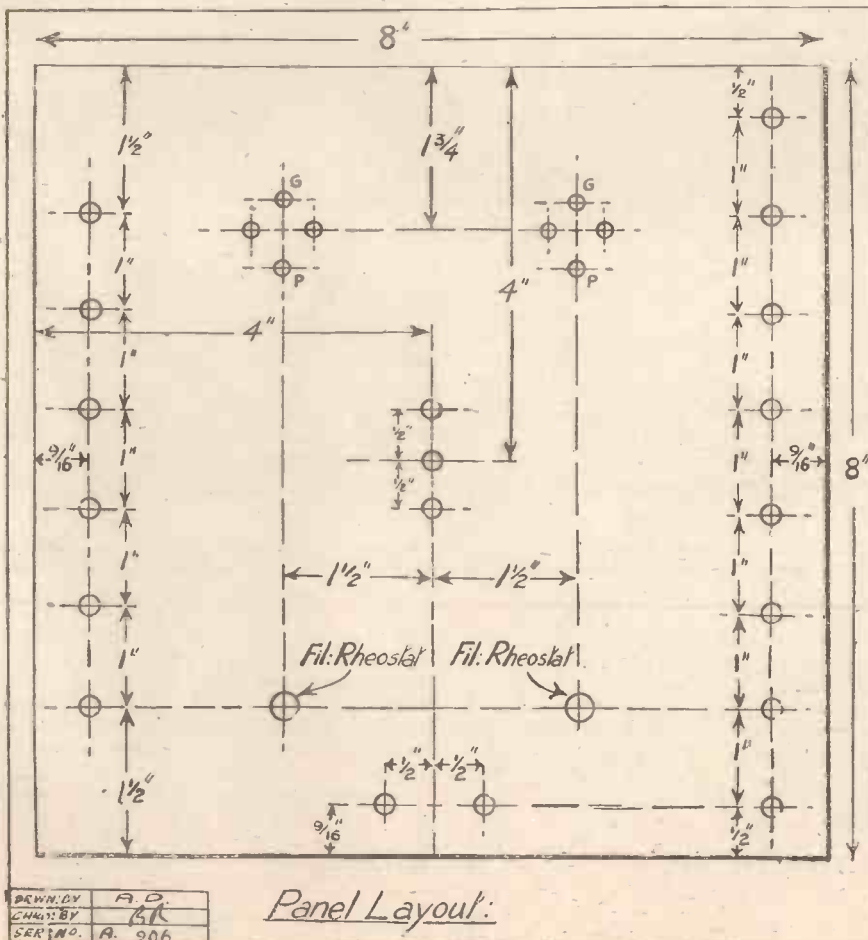
If the switch is thrown in the "2 L.F." position, the plate current of the first amplifying valve will be supplied by H.T. plus 2, and in this instance it will flow through the anode resistance. Varying potentials will therefore be set up across this resistance, which is coupled to the grid of the next valve by the .025 fixed condenser. The amplified signals will finally be audible in the plate circuit of the last valve, where the "telephones" are connected. (For the sake of clearness, telephones have been shown upon the blue print and wiring diagrams, but in actual practice it will be found that where the original detector set is capable of normal headphone results, the amplifier will work a loud speaker at good strength.)

The first step in construction is the assembly of components. Recently great attention has been paid to the "matching" of various parts of the receiver, for instance, the L.F. transformer and the preceding valve, or the loud speaker and the impedance of the last valve.

Frequently this point is over-emphasised, but nevertheless it is a good plan to match the parts in the set as far as possible. The makers of the L.F. transformer, for instance, may have found by experiment that a particular valve will give the best possible results in conjunction with their transformer. In such a case the explanatory literature sold with the L.F. transformer will inform constructors of the valve which



When wiring up the receiver, compare this photograph with the wiring diagram.



is recommended, or alternatively the advice of the manufacturers may be sought direct. In this way the last ounce of efficiency can be obtained, but for ordinary purposes standard components will be found to give standard results.

As an example it may be said, in passing, that when this particular amplifier was tested in the "P.W." laboratory, it gave excellent results upon half a dozen different makes of valves. Those shown in the photographs are (1st), Mullard D.3 L.F. (green ring), and (2nd), a Mullard P.M.2. When a 6-volt accumulator was employed, excellent loud-speaker signals were obtained with a Cosor P.1 as 1st L.F., and a Cleartron C.T.25 as 2nd L.F.

The batteries for use in conjunction with the set will depend upon the valves chosen. In most cases a 9-volt grid bias battery will be sufficient, but the H.T. required at the H.T. plus 2 terminal will be above the normal 60 volts, as the resistance-capacity method of L.F. amplification requires a high anode voltage to function efficiently.

Drilling the Panel.

Generally, best results are obtainable with a 120-volt H.T. battery, but 90 volts give good results, and often there is no serious distortion or lack of amplification when only 66 volts are used. Nevertheless, a battery of 90 or 120 volts is recommended in the majority of cases.

The actual construction is commenced by drilling the panel. The dimensions for this in the particular set shown in the photographs are given on this page. Where different components are used slight modifications will be necessary, but if a panel of the dimensions shown is employed it should be quite easy to arrange standard components upon it. After the various parts have been mounted in place, the wiring is carried out. (Square section

(Continued on next page.)

A "P.W." TWO-VALVE AMPLIFIER.

(Continued from previous page.)

POINT-TO-POINT CONNECTIONS.

The two input terminals of the amplifier are joined direct to the primary (I.P. and O.P.) terminals of the L.F. transformer.

One secondary terminal of the L.F. transformer (I.S.) is taken to the grid socket of the 1st valve holder, and the other (O.S.) to L.T. negative, which is also joined to H.T. negative, grid bias positive and to the corresponding terminals on the opposite side of the panel.

A lead is taken from H.T. negative to one side of each of the rheostats; the other side of each rheostat goes to one filament socket of the corresponding valve holder. The other filament sockets are joined together and to the lead joining the two L.T. positive terminals.

Plate socket of 1st valve holder to centre contact of switch, top contact of switch to one side of anode resistance and one side of coupling condenser (.025), other side of anode resistance to H.T. positive 2.

Other side of coupling condenser to grid socket of 2nd valve holder and one side of grid leak, other side of which goes to grid bias negative.

Plate socket of 2nd valve holder to bottom contact of switch and to one 'phone terminal, other phone terminal to H.T. positive 3. A .002 fixed condenser is connected across the 'phone terminals.

A lead joining the H.T. positive terminal (on the "input" side of the panel) to the terminal marked H.T. positive 1 completes the wiring.

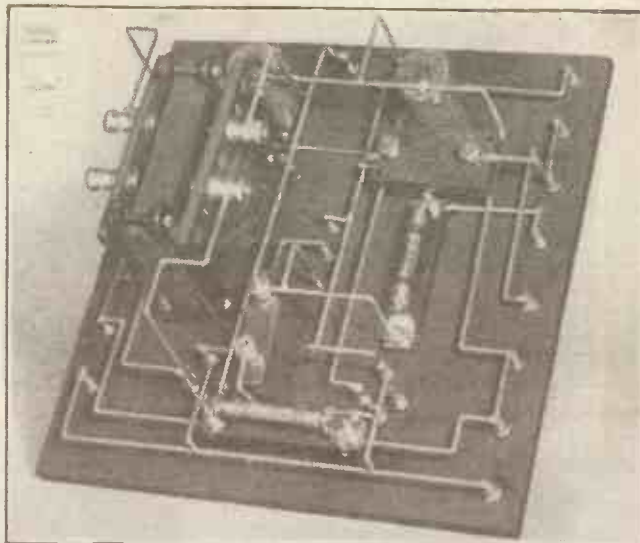
tinned copper wire is shown in the photographs.) All the connections are clearly marked on the wiring diagram (or blue print), but in cases where the amplifier is to be used with a valve set, one slight modification in the wiring may be necessary, if a common L.T. battery is to be used for both sets.

It may happen that in the valve set employed as detector, the H.T. — terminal is not connected to L.T. — (as in the amplifier), but is connected instead to L.T. +. In such a case the two short wires in the amplifier which join the L.T. negative to the H.T. — terminals should be omitted, and the wire which joins O.S. and the two rheostats should be taken to L.T. — instead of to H.T. —. (This leaves the H.T. — terminals isolated, but as the connection to H.T. — is made through the detector valve circuit, this is quite immaterial.)

Self-Supporting Components.

An inspection of the photographs will show that the grid leak which is connected to grid bias negative is not actually mounted upon the panel, but is supported in place by its own wiring. The same applies to the telephone condenser.

The rest of the construction will present



Another view of the back-of-panel connections which will be useful when wiring up.

no difficulties, but when the set is used in conjunction with a crystal detector, it is generally advantageous to connect an external lead from the L.T. negative terminal to the earth terminal on the crystal set.

L.F. Amplification for Volume.

Regarding the results obtainable under normal conditions with an amplifier of this class (i.e. an L.F. amplifier) there is one point which it may be as well to emphasise. It is often supposed that the addition of an amplifier of any kind will necessarily increase a number of stations which is possible to tune in. This is not the case.

It is possible by means of amplifiers to increase either the range of the set or the volume of its output. For the former *high-frequency* amplification is required, and in such a case, although more stations can be picked up, the strength of the signals received is still only suitable for headphones.

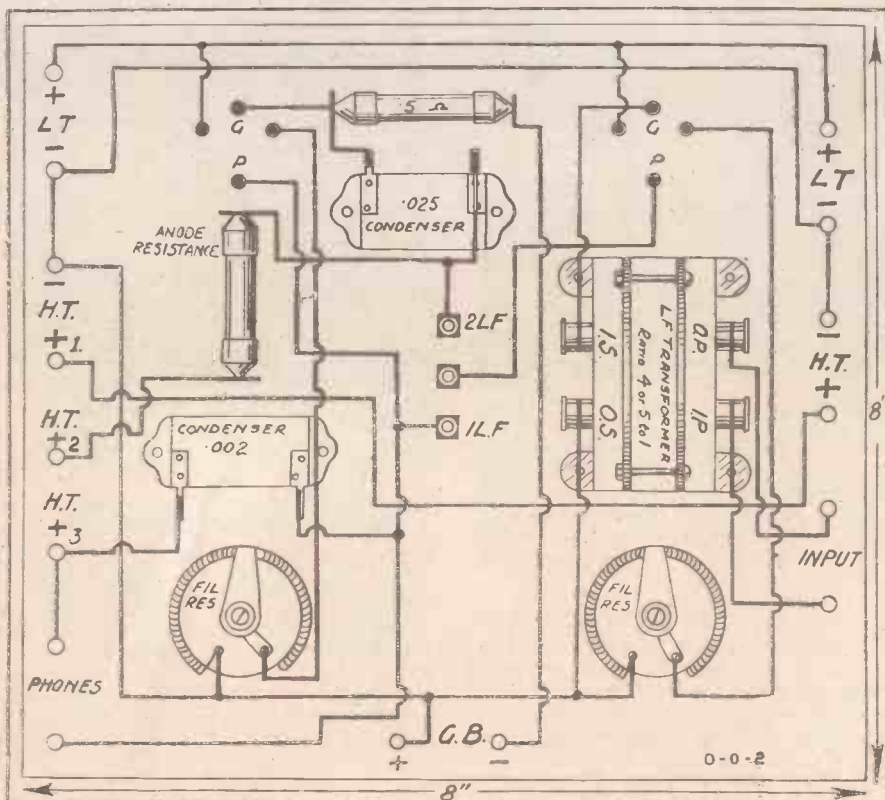
On the other hand, *low-frequency* amplification increases the volume of the signals already receivable, but generally speaking it does not bring in new stations.

A Straightforward Set.

So if your detector is already able to receive, say, 5 X X and the local station only, it is probable that with this amplifier these will still be the only stations that can be tuned in. But whereas previously they were received at, say, good telephone strength, the programmes will now be produced at good loud-speaker strength.

In short, if distant stations are required, *high-frequency* amplification must be employed as a low-frequency amplifier of the type described here is not suitable for that purpose.

Being a perfectly straightforward set to build, if reasonable care is used in construction, the amplifier will give excellent service from the moment it is connected up.



PHOTOGRAPHS.

Readers are invited to submit photographs of wireless interest for publication in "Popular Wireless." Every photograph accepted and published will be paid for at the rate of 10/6 per copy.



Conducted by our Staff Consultant, J. H. T. ROBERTS, D.Sc., F.Inst.P.

A GOOD many readers have written asking various questions relative to the use of tantalum for rectifiers and, in particular, as to the amount of metal which is required for the passing of the ordinary charging current of, say, two amperes or so.

In the first place, I should like to correct what appears to be a common misapprehension on this point. It appears (perhaps not unnaturally) to be the popular impression that the current-carrying capacity of a piece of tantalum, when acting as a rectifier in sulphuric acid, is proportional to its area. This, however, is not the case.

"Sensitive" Spots.

The rectification takes place in a very peculiar way, and as a full consideration of this particular matter would lead me far beyond the space at present available, I will cut short by saying that by far the largest proportion of the metal is ordinarily inactive, the rectification taking place at a number of isolated spots. The reasons why these particular spots take preferential part in the action is one of the matters that I must leave until another occasion. But the fact is that they do. Consequently it cannot be considered that if a piece of the metal of a certain area passes a certain current, a piece twice the size will pass twice the current. As a matter of fact, the amount of the metal required for the passage of one ampere is comparatively small.

It is interesting to note that there are certain reasons why it is, for practical purposes, impossible to pass more than about three amperes through a rectifier of this kind. I should only like to add here that, in case any of my readers are thinking of experimenting in this direction, it is very important to add a small quantity of ferrous sulphate to the dilute sulphuric acid. The sulphuric acid should be ordinary battery strength, and the amount of ferrous sulphate, which acts as a depolariser, should be very small; about as much as will lie on a shilling is ample for quite a large rectifier containing a pint of the dilute acid.

Shielding H.F. Coils.

In connection with the common practice of shielding coils by means of metal covers, it should be remembered that, just as the shield absorbs extraneous or incoming radiation (which is its intended purpose), so it absorbs a percentage of the energy legitimately passing in the coil. If shielding can be avoided, it is better so. If, however,

it has to be resorted to, it is highly important not to have the shield in too close proximity to the coil.

The Best Aerial?

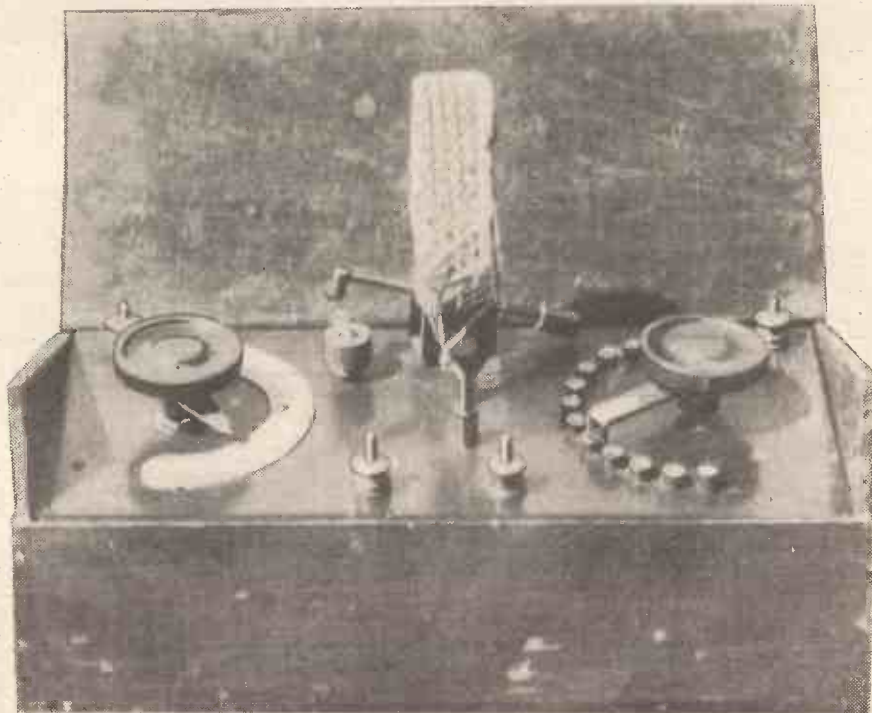
With reference to the discussion on aerials which has taken place recently in these notes, I have an interesting letter from one of my readers, Mr. L. J. Quinn, in which he described one or two types of aerial

have the usual 3 egg insulators which can be slung on to hooks in any part of the room to get directional effects. At the end of the coil from which the down-lead is taken I have soldered a telephone terminal to which I clip the down-lead. The results (indoor) have surpassed my expectations. I think it would be well worth any of your readers' time to make up and try out this aerial, and the cost of material is negligible."

"Relaxation Vibrations."

A well-known Dutch scientist has predicted the existence of certain special types of ether waves, as a result of his mathematical investigations, and it is believed that the results of his work will have important bearings on wireless transmission. The exact nature of his discoveries is difficult to describe in simple language, but he discusses what are termed "relaxation vibrations," and these differ considerably from the normal in some of their properties. One important feature of the "relaxation vibrations" is that they are very rich in overtones, and this evidently will bring with it many new problems and many new possibilities. The vibration period is connected with capacity and resistance.

At present the practical application of these investigations is in connection with the



A simple crystal set constructed by a "P.W." reader—Mr. F. Phillips, of 41, Marine Avenue, Hove.

which he has himself designed and used with considerable success. His best aerial was one employing copper balls, and perhaps the simplest way to describe the aerial would be to quote Mr. Quinn's letter:

"The new aerial is made from two 5-inch copper balls, such as plumbers use, each bored through the centre and a $\frac{1}{4}$ -inch copper wire passed through and turned over to form hooks on each side of each of the balls, the hooks being soldered to the respective balls. Between the two balls, and soldered to the copper rods, I have a coil (20 turns of copper-bronze wire, 16-gauge) made on a 4-inch former.

"On the opposite sides of the balls I

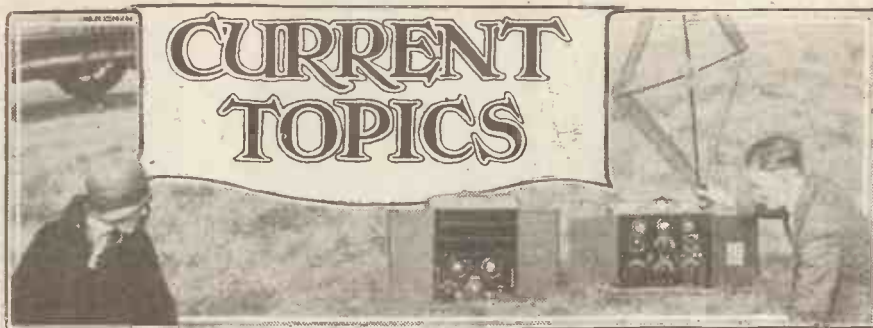
3-electrode valve, and it is believed that some important practical results will shortly be forthcoming.

Another New Aerial.

Referring to the subject of aerials, I notice that a patent has recently been granted for a ribbon aerial which consists of two metal strips ingeniously twisted together so as to provide a large area for reception. It is claimed that this aerial has a high receptive efficiency.

A well-known German radio engineer, Dr. G. Seibt, has lately devised a special

(Continued on page 544.)



By THE EDITOR.

WHETHER mountains can be made out of molehills or not is a question geologists can settle among themselves; but as a metaphor the expression is suitable when writing about the B.B.C.'s "editorials." As our correspondent O. H. M. points out in this issue, a state of emergency existed in regard to broadcast matter from 2 L O for some days after the settlement of the general strike, and it was under this state of emergency rule the controversial editorials about which there has been such a hullabaloo were broadcast.

The "Reviews."

It has been suggested that these editorials were inspired from a Government source, but about that we have no confirmatory evidence. Throughout the strike the job of broadcasting news was done admirably, and there seemed no doubt, to those who took the trouble to analyse the broadcast reports, that the Government was the power behind the throne as regards the political tone of the news bulletins. As a writer in the "Nation" and the "Athenæum" stated, there was little or no gross propaganda: "The droning of train-times proved as soothing as the blessed word 'Mesopotamia.'"

It is undoubtedly a sound rule to keep off controversy and there can be no doubt about the fact that the coal strike is an acute controversy. "Feeling is inflamed, and the most harmless seeming word (to quote the above-mentioned journal) will cause impotent fury in some listener who cannot assert himself like a man at a public meeting by shouting 'liar.'"

However, the B.B.C. have changed the word "editorials" to the word "reviews," and to judge from them in their new form there is little in them which displays any political bias; they seem to be explanatory reviews of news and to quote a B.B.C. official—"to stress the elementary points of general agreement in the subjects discussed."

The Danger of Controversy.

Mr. Bernard Shaw has already pointed out in connection with broadcasting that there are few, if any, subjects of interest that are not controversial. Some of the scientific talks given by the B.B.C. are acutely controversial. Two scientific friends of mine were listening to a pseudo-scientific gentleman air his views on the wireless one evening at my house, and it required the diplomacy of a Machiavelli, the strength of a Hercules, and the patience of Job, to keep those two friends of mine from smashing up my wireless receiver and,

incidentally, each other, so diverse and so bitter were the opinions of each of them, and so opposite to those of the gentleman who was broadcasting his scientific talk—probably sublimely unconscious that he was being controversial.

Science, religion and politics will always provide men with an excuse for controversy and passion, and although the B.B.C. may protest with all sincerity that they do not desire to arouse controversy among their listeners, they will, inevitably, so long as they broadcast anything to do with science, religion and politics, create argument, and possibly bad feeling, among certain sections of their audience.

There is, of course, a distinct danger of propaganda creeping into broadcast programmes, but so far the impartial critic of the programmes must admit that the B.B.C. have kept their hands clean in this respect, and that their impartiality has been not only one of their greatest assets, but one of their greatest triumphs.

Although we do not regard their reviews, or editorials, or whatever they call them, with any seriousness, we think that, on strictly impartial grounds, they can be legitimately accused of "stepping in where angels fear to tread," and of laying themselves open to an attack which, on technical grounds, is justifiable.

"Talks."

One of the most pleasant announcements from 2, Savoy Hill, of late is that the instructive talks [sic] arranged in series will terminate very shortly and will not be resumed until October. The 9.40 talks will also be shortened, and will be on general matters of interest, and the 7.40 talks will be apportioned according to the needs of each station's programme. The principal talk will be at 7.40 p.m.

The French talks, it seems, will probably take the form of dialogues suitable for tourists. We should suggest also that as an example of restraint in a foreign language, a Cook's official from the Gare du Nord would provide some very interesting dialogue eminently suitable for tourists.

We are not so sure that the idea of taking advantage of the holiday period for the B.B.C. to try some new experiments—such as serial stories by popular authors running over several evenings—is not going to arouse another controversy. It is all very well to listen to a short and classic and intensely interesting short story, read aloud by a first-class speaker, but it is a different matter when authors and authoresses are let loose in front of the microphone to read their own writings.

If the B.B.C. are going to broadcast

stories, we hope they will engage a permanent reader; a man trained in the art of reading aloud and holding the attention of his audience, if not by the interest of the story, at least by the charm and personality of his voice.

Many a playwright who has persuaded a manager to listen to him read an act from his new play, has ruined his chances of having that play accepted because his rendering of the play, his method of reading it, has absolutely killed, in the mind of his listener, any interest and any appreciation of what he has written.

Mr. Baldwin's Set.

It is hardly topical these days to write about broadcasting and the general strike, but there has come to our notice a little story in connection with the strike which we feel must be brought to the notice of our readers. Really a little tragedy, and when we heard this story we cried aloud: "Why, oh, why, did not Mr. Baldwin ring up POPULAR WIRELESS!"

It appears that Mr. Baldwin's wireless set at Chequers broke down. According to the "Weekly Dispatch," Mr. Baldwin was determined not to be without one, and he immediately telephoned to the B.B.C.'s headquarters at Savoy Hill and explained what had happened. An expert from the Development Department was at once rushed to Chequers in a motor-car to put matters right. He examined the set and came to the desperate conclusion that the defect was too deep-rooted to permit of its repair on the spot.

Quick Work!

Not having had the forethought to take a spare set with him, and in view of the importance of the matter to Mr. Baldwin, we would have thought that that would have been the first precaution of the expert; he took the complete set back to London. The rest is dramatic, and we quote verbatim from the "Weekly Dispatch":

"There the expert designed a special circuit and passed the set along to the B.B.C.'s mechanics, who took it to pieces [sic] and reassembled it according to the new design. The work was performed with despatch [sic] and within 48 hours [sic] of the expert's visit to Chequers the set had been sent back and installed in working order."

And so for two days during the national crisis the Premier was without a wireless set. Terrible!

In future, during a national crisis, POPULAR WIRELESS will have much pleasure in informing all public men connected with the crisis that if their wireless sets go wrong, a member of the Technical Staff of "P.W." will guarantee that, if called to the "scene of the breakdown," the set, or a substitute for it, will be installed, not in 48 hours, but in less than 48 minutes!

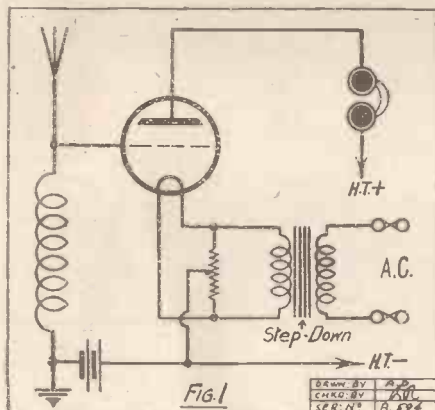
Portable Sets.

Here is an interesting announcement from the Post Office (not copyright in the United Kingdom, or to ships at sea). The Post Office states that "there is no objection to listeners' wireless receiving apparatus being used occasionally at a different address to that given on the licence. If, however, the apparatus will be used more or less regularly at the second address, or if a permanent aerial is erected, a second licence is necessary."

FILAMENT LIGHTING FROM A.C. MAINS.

FROM A CORRESPONDENT.

THE growing practice amongst electricity supply companies of using A.C. must be complicating the problem of filament lighting from the mains for many hundreds of people. The use of A.C. for



L.T. supply has, however, been tackled, and although it is said to be successful for L.F. amplifying valves there is a fairly widespread belief that for detector valves

and bring the grid connection to the slider. If the grid connection were taken to one side of the filament there would be a loud hum in the telephones, because the voltage at that point of connection would vary from max. positive to max. negative.

Two Useful Circuits.

One scheme is shown in Fig. 1, from which it will be seen that anode rectification is employed. The battery is important; it must be carefully insulated and its voltage will vary from $1\frac{1}{2}$ volts to 12 or 14 volts, according to the type of valve used. It will probably be found an improvement—or a necessity—to screen the transformer, and the lead from the mains to the primary of the transformer should be of screened and twisted lead-covered or metal-wound cable. Either bright or dull emitters may be used.

Satisfactory results have been obtained with the arrangement shown in Fig. 2. Here reaction and grid-leak rectification are employed, the leak being variable.

If sufficient care is taken with the screening and other details referred to it is possible to reduce the A.C. hum so much that it can be heard only when transmission has stopped.

TECHNICAL NOTES.

(Continued from page 542.)

type of head telephone receiver which is distinguished in that it has means for damping the vibrations of the diaphragm. This is accomplished by providing a second diaphragm about $\frac{1}{8}$ of an inch behind the main diaphragm: the subsidiary diaphragm is perforated with a large number of holes and the space between it and the casing of the receiver is tightly packed with some damping material such as cotton wool.

The cotton wool projects through the holes in the subsidiary diaphragm and makes light contact with the back of the main diaphragm, thus introducing a damping effect which, it is claimed, can readily be adjusted to the right amount.

It seems to me that, as a rough approximation to this, the packing of the case with cotton wool, provided it is done lightly and not too tight, would be quite suitable.

Whilst on the subject of telephones, readers may have noticed that the S.D.H. Company have brought out a new Dr. Nesper loud-speaker unit which is very powerful and gives a very good tone. The unit is not provided with legs but simply lies flat on its back, the loud-speaker horn being fitted into a special socket. The diaphragm is of stallo and 3 inches in diameter.

Underground Aerials.

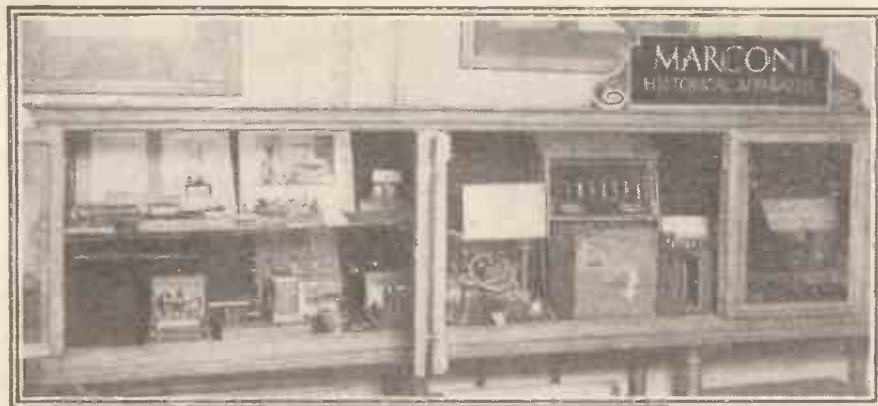
A good deal is heard from time to time of underground aerials, but most amateurs regard them with a certain amount of scepticism. I recently had an opportunity of examining one of these underground aerials, however, which, I must confess, gave very good results. The aerial consists of a length of about 75 or 100 feet of lead-sheathed wire and is loaded with coils at the end and in the middle.

A hole about 3 feet square and about 4 feet deep is dug in the ground (in the garden, for example), and the lead-sheathed wire is laid in a flat coil at the bottom of the hole, then about a foot of earth is thrown upon it and the winding continued in a second flat layer, another foot of earth, and so on, until in all there are three or four of these flat layers vertically above one another and separated by about a foot of earth between adjacent layers.

The lead-in is brought into the house in the usual way. An underground aerial of this type has the evident advantage that it is practically invisible and consequently should appeal to those people who object to the sight of an ordinary extended outdoor aerial.

Furthermore, it is claimed by the inventors that the aerial has a sensitivity as good as that of an average outdoor aerial. The principal drawback would appear to be the trouble involved in digging the hole 3 feet square and 4 feet deep, which is an operation involving a considerable amount of labour on the part of the amateur, or, alternatively, some little expense in case the labour is hired. Moreover, the underground aerial is somewhat more expensive than an outdoor aerial.

Should any of my readers decide to try this unconventional method of receiving broadcasting I shall be glad if they will let me know how they get on and what results they obtain.

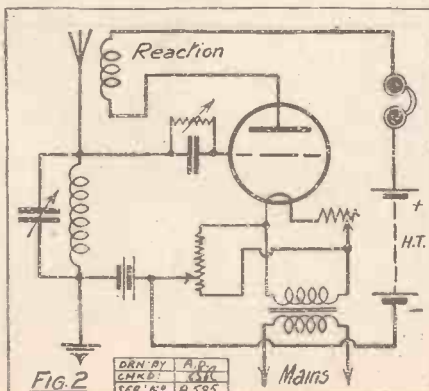


A photograph of one of the show cases containing historical wireless apparatus to be seen at Marconi House.

it is unsatisfactory. That belief is not justified, though it is true that to apply A.C. to detection requires considerable care in arranging the leads so as to avoid noises due to induction.

Avoiding Interference.

The main secret of success is the transformer. If this is wound by the reader care should be taken that the primary is suitable for the supply voltage and the secondary for 6 volts. A tapping should be taken from the centre of the secondary for connection to the grid. As an alternative a bell-ringing transformer may be used; this will have a 3, 5, or 8 volts secondary. Connect across its low tension terminals a potentiometer of 300-400 ohms resistance





WHEN listeners in Britain are for the most part closely crowding around cosy fires listening to the broadcasts coming steadily in through the wintry weather outside, their fellow-listeners in Australia and New Zealand are probably enjoying their broadcasting at pleasant picnics in the shady "bush," or on the long, sandy beaches where the music has a fitting background in the cool murmur of the heavy surf. Soon after the rush of the Christmas season is the popular time for holidays at the Antipodes, where the warm summer sun blazing from fair blue skies, the sweet scents, and the sleepy songs of the birds make ideal settings for "wireless picnics."

But all the world over listeners are very much alike despite dissimilarities of climate and conditions: all want good broadcasting and novel programmes at the least possible cost, and all are capable of kicking up a tidy noise if they think they are not getting it! For these reasons the development of broadcasting on the other side of the world has generally followed closely along the lines of its progress in Great Britain, and broadcasters keep a close watch on Britain and America for innovations which might be applicable "down under."

Australian Licence System.

Australia, being much the larger of the two southern countries with its far-flung population of five-and-a-half millions, was the first to wake up to the joys and vicissitudes of broadcasting. Amateurs and dealers started to make more or less horrible noises with gramophones, to the incredulous delight of those exposed to the din through the uncertain agency of bobbins of wire and a lump of crystal. However, these early pioneering efforts deserve high praise for introducing to young Australia the delights of broadcasting.

Now, less than three years later, the broadcasting service in Australia might not unfavourably be compared with the British; while the number of licensed listeners has increased from zero to roughly 100,000. The real number of listeners it is impossible to estimate, as Australia, unfortunately, suffers from a large proportion of "pirates," although the license fees amount to only 17s. 6d., 22s. 6d., or 27s. 6d. per annum, depending on the distance of the listener from the nearest "A" Class broadcasting station.

There are four high-powered stations in Australia, one each in Perth, Adelaide, Melbourne and Sydney; while there are

Listening-in is as popular in Australia as it is in Britain, and is of immense advantage to the lonely people "out back"; while New Zealand is a paradise for the DX fiend.

a round dozen secondary stations in these cities and in the chief towns. The highest-powered station is 5CL Adelaide, which uses an input of from 12 to 14 kilowatts. Station 3LO Melbourne is extremely popular, and serves listeners in most parts of Australia, as well as in New Zealand, 1,300 miles away.

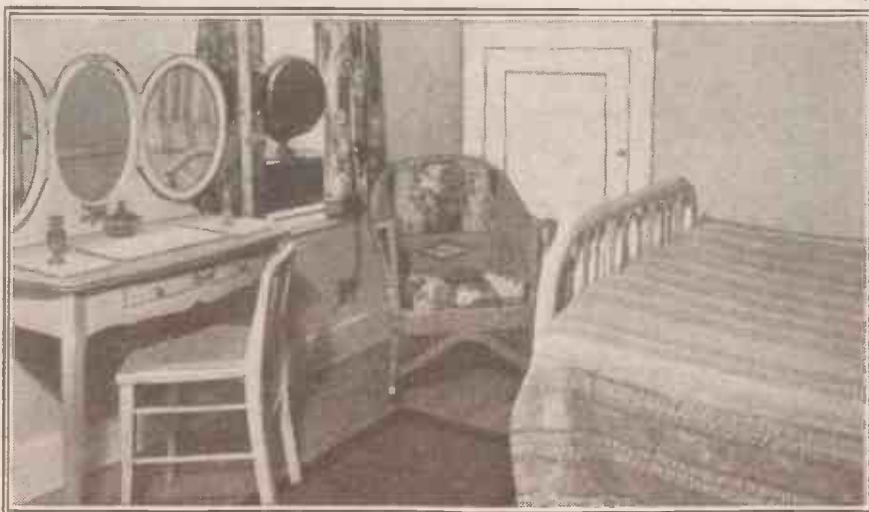
In a country as large as Australia, it is inevitable that there should be many lonely places, and in this connection many lonely men and women put in the back-blocks, and many a pioneer in the bush,

Although amateur broadcasting has been carried on in New Zealand for four years, and a fairly good secondary service for the last twelve months, the country has not yet a good broadcasting service. This is expected to eventuate in June of this year, however, as Western Electric apparatus has already been ordered by the newly formed Radio Broadcasting Company.

"DX Paradise."

Luckily for New Zealand listeners though, this country is a paradise for long-distance reception. The concerts from the Australian stations, the nearest one of which is 1,300 miles away across the ocean, are a regular source of entertainment.

Concerts are also received from stations all over the United States, including New York and Chicago—9,000 miles away. Whole programmes may be received from America any evening, but static is a bug-



One of the bedrooms in the Radio House recently erected on Staten Island, New York. All the rooms are fitted with loud speakers.

have cause to bless this boon of wireless which brings to them news and entertainment from "back home" in the cities.

Besides the high standard of entertainment brought to the studio from the city theatres, and broadcasts from the studio itself, many novel "stunts" continually keep the interests of listeners at a high pitch. A station recently sent down a diver, who broadcast his experiences on the bottom of the harbour.

bear as it is necessary to employ a stage or two of radio-frequency amplification.

One listener at least claims to have heard station 2LO London, where the orchestra was being conducted by his own brother. Stations in America have been re-broadcast at the Antipodes, and it seems quite possible that British stations may be re-broadcast here in the future, although listeners here would have to take the evening programmes with their breakfasts!

BROADCAST NOTES.

By O. H. M.

The Emergency Status—"The Editorials"—Forthcoming Attractions
—The New Daventry Experimental Station—Television and Broadcast-
ing—Reduction in Talks.

The Emergency Status.

AS readers of this page would anticipate, the B.B.C. was likely to get into trouble with the Press after the general strike. My only wonder is that the trouble has been so slight. I think it speaks worlds for the discretion of the Savoy Hill people that they have managed the aftermath of the strike so adroitly. As I see it, they were bound to make a "demonstration in force" to cover their retreat from the strike regime.

Curiously enough it has escaped the notice of many people that the B.B.C. remained in its Emergency status until Wednesday, May 26th. I understand it was not until then that the Post Office resumed being the Government point of contact with the B.B.C. Thus, presumably, the much discussed "editorials" on the coal stoppage had the approval of the Government, but not of the Post Office officials. I would not be surprised if they were definitely inspired.

Some critics of broadcasting have attacked these editorials for being biased, but it is significant to note that no two critics agree as to which way they were biased. Which is proof that they were not biased.

"The Editorials."

The short series of editorials on the coal stoppage having served its purpose, was followed by a series of topical reviews. Many people say they preferred the editorials. There is too much caution and trimming in the topical reviews. Of course the crux of the matter is controversy.

We have reached a stage when broadcasting should be allowed to handle current controversy. And the best way to do it is not through editorials, but through developing a forum before which subjects can be thrashed out.

Forthcoming Attractions.

I hear that experiments are in hand with a view to broadcasting the open air performance of "A Midsummer Night's Dream" by the O.U.D.S. at Magdalen about the end of June.

The introduction of the microphone into the Royal Gallery of the House of Lords for the speeches at the banquet of the International Parliamentary Commercial Conference has caused a flutter in official circles.

Those influences which prevented the broadcasting of the Budget speech are indignant at the recent innovation. They regard it as a breach of parliamentary privilege, and they propose to hammer the B.B.C. for it. It is difficult to see how the B.B.C. is to blame.

The New Daventry Experimental Station.

Work has been started on the new Daventry experimental station. This should be ready to put out programmes by October. These will be alternative to 5 X X and 2 L O. So far so good. But it is a very

small instalment of the new distribution scheme so long promised. It looks like being 1928 before British broadcasting really gets properly equipped with adequate alternative programmes. The delay is deplorable.

It signifies the worst kind of senseless official obstruction. I do wish the B.B.C. would come out and take the public into its confidence instead of trying to protect the Post Office.

If the trouble is the obsolete and obsolescent apparatus of other services, then I think it would be a good investment for



A corner of one of the rooms in the new Radio House recently built on Staten Island, N.Y.

the Post Office to offer a chunk of the reserve licence money as compensation.

I hear that at the initiative of some grateful listeners a big "Thank you" programme is being organised at a London theatre in recognition of the work of the B.B.C. during the strike. The performance will be all-star and of course will be broadcast, all proceeds going to charity.

It is known quite definitely that there will be at least one signal recognition of broadcasting in the delayed Birthday Honours. I am told that there will be a knighthood and a C.B.

Rumour has it that a new syndicate has been formed to start competitive broadcasting. The idea is to take advantage of the clause in the B.B.C. licence which gives

the P.M.G. the right to sanction other companies if the B.B.C. programmes are not satisfactory.

I confess I don't quite see how the promoters of the new syndicate are to prove that the B.B.C. programmes are unsatisfactory. Their only strong card, of course, is the lamentable absence of alternative programmes, but this is clearly not the fault of the B.B.C. I imagine the promoters of the syndicate will lose their money.

Television and Broadcasting.

There is active speculation about the future of television. Will it be linked with broadcasting or the cinema? The B.B.C. are watching it closely, but they have got the money to compete with the cinema industry if it comes to out-bidding. It would be a grave pity to allow television to become an adjunct of the screen.

Reduction in Talks.

The announcement of a 60 per cent. reduction in talks during the summer was

welcome to most listeners. The B.B.C. was wise to take this step. There is no doubt we have been having too much talk lately, and I hope the summer policy is only slightly modified in the autumn.

The recent overburdening of the programmes with talk was perhaps due to a desire to conform to the recommendations of the Broadcasting Committee.

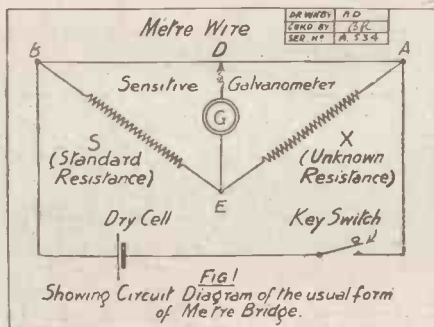
If so, it was a mistaken move. The listening public is frankly tired of talk, and until there are alternative programmes the B.B.C. should run very slowly with education and uplift. The principal talk of each evening will be at 7.10 p.m., and this will be of a lighter character suited to the summer season.

The B.B.C. also proposes to take advantage of the holiday period to try some new experiments, such as serial stories by popular authors, running over several evenings.



By W. SHERELIFF, B.Sc.

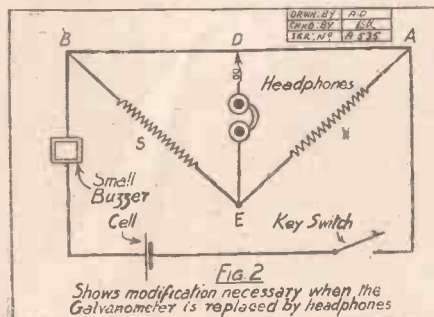
AN experimenter frequently needs to know the resistance of a component such as a valve filament, filament rheostat, transformer winding, etc. The usual method of measuring resistances in the laboratory is by some form of Wheatstone's bridge.



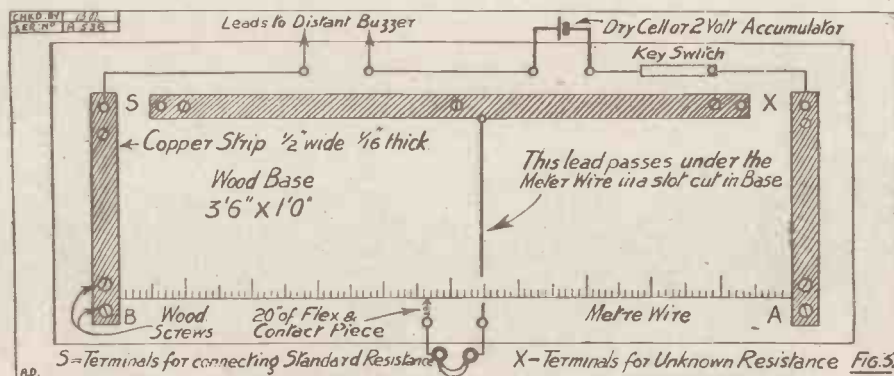
As usually employed, this instrument involves the use of a delicate galvanometer, sensitive to currents of 1 micro-ampere, also a set of standard resistances. It is possible to dispense with the galvanometer, using instead a pair of headphones, which are just as sensitive; and if one or two standard resistances are purchased the rest of the set can easily be made. The instrument itself is also easy and cheap to make.

Simple Calculations.

The theory is very simple. Fig. 1 shows the circuit diagram of the usual form of apparatus. When the key switch is closed the current from the cell divides, part following the path B, D, A, which is a metre of bare resistance wire (1 to 5 ohms would be suitable), and part following the path B, E, A, which consists of a standard resistance S, the unknown resistance X, and connecting leads of negligible resistance. The galvanometer is



connected as shown, D being a sliding contact which can be made anywhere on the metre wire. The galvanometer will register a current for all positions of D, when the key is pressed, except one.



D is varied until this position of "balance" is found. We then have the following relation between the various resistances in the circuit:

$$\frac{X}{S} = \frac{\text{Length DA}}{\text{Length DB}} \quad \text{or} \quad X = \frac{S \times \text{Length DA}}{\text{Length DB}}$$

From this the value of X can be found.

Fig. 2 shows the modified arrangement used by the writer. In this case, when the key is pressed, the note of the buzzer is heard in the 'phones for all positions of the contact D. The buzz is, however, very faint in one position, which is the position of balance. When this is found the relation $X = \frac{S \times \text{Length DA}}{\text{Length DB}}$ is again true. Fig. 3 shows the practical form of the instrument. This may be purchased or made. Details are shown in the sketch.

Isolating the Buzzer.

It is important that the resistance of the leads in the divided part of the circuit should be very low. They are best made of copper or brass strip, but a stout copper wire would do. The resistance of the leads from the battery and buzzer does not matter, nor does that of the 'phone circuit from D to E.

As the noise of the buzzer itself is easily heard apart from, and louder than, its note in the 'phones, it is necessary to place it some distance away. The writer attached it to a few yards of twin flex and put it out of the window and allowed it to hang. Only the noise in the 'phones was then heard, and there was no difficulty in

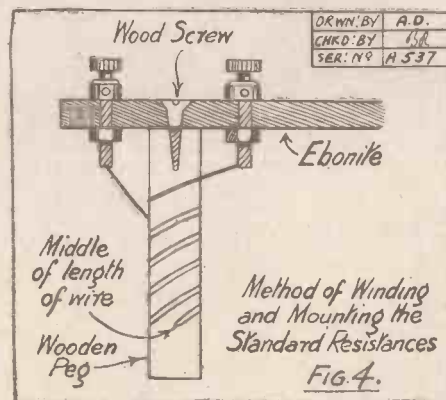
ascertaining the position of "balance" to within a millimetre.

The length of the "metre" wire does not matter as long as the exact lengths DB and DA can be found. A scale marked on the baseboard is, of course, convenient. A useful form of contact for D is shown in Fig. 5. This can be applied to the metre wire with one hand, whilst the key is pressed with the other.

Standard Resistances.

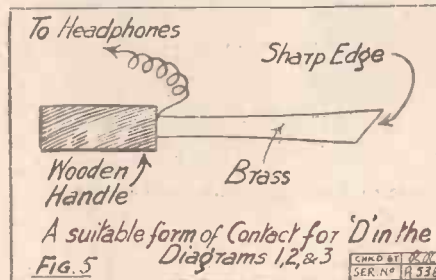
The other chief difficulty is the matter of standard resistances; a set of these may be purchased from any dealer in physical apparatus. One, of course, must be purchased, unless it can be borrowed. Suppose a 10-ohm resistance is purchased, which will cost about 4s. 6d., and a quantity of silk-covered resistance wire. The 10-ohm coil is placed in the position S, and a length of several yards of the resistance wire in the position X. The resistance of X can then be found. The lengths of wire

to make other standards can then be worked out. A series of, say, 1, 2, 5, 10



20, 50, 100, 200, 500, 1,000, 2,000, 5,000 can be made up.

(Continued on next page.)



WHAT IS SELECTIVITY?

FROM A CORRESPONDENT.

"SELECTIVITY" is the most misused term in the radio world to-day.

By some lamentable mischance, the meaning of the word has been lost sight of, or confused with *sensitivity*, and thousands of enthusiasts do not appreciate the difference between these two totally different conditions!

Now is the time to pause for a moment over these two words, and ask yourself: "Do I know the difference between selectivity and sensitivity?" If you are quite sure that you do, there is no need to read

ever signal is being received, it is possible to move the tuning controls *slightly* and shut out this signal by the consequent change in wave-length. (Whether or no another station's signals will be received at the new adjustment depends not upon the set's selectivity, but upon its sensitivity—i.e. its response to weak signals. If this response is good, the chances are that there are stations to be had "all round the dial.")

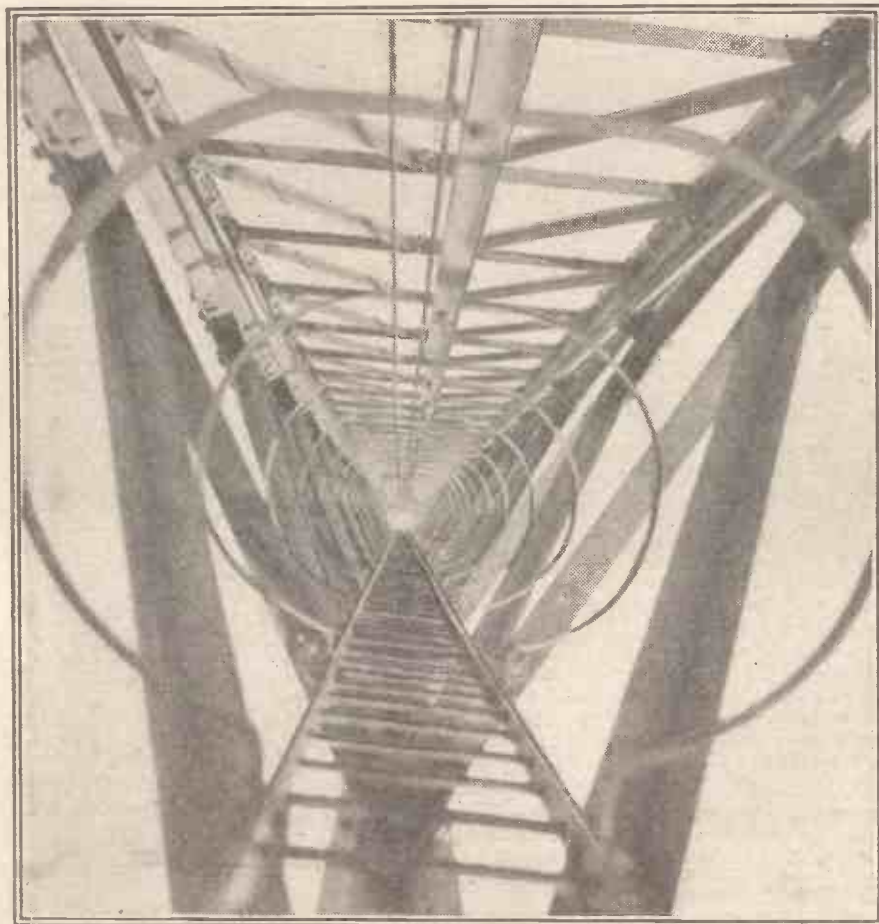
Both of these conditions may exist together, or either of them separately. A one-valve set with good sensitivity will rope-in

and a touch of the tuning dial will cause the local station to vanish completely, but no other station comes in instead! He has increased selectivity, but was expecting to increase sensitivity as well, which is far beyond the reach of a wave-trap's possibilities.

Clearly Defined.

How then can sensitivity be increased? If we take for instance the case of a one-valve set, the sensitivity can be increased to a moderate degree by the addition of an L.F. valve, or to a great degree by the addition of an H.F. valve. Fortunately, H.F. amplification also increases selectivity (when the set is properly handled) and that is why the "P.W." Continental set (H.F. and Det.) has given such good results under all sorts of conditions.

The limitations of space prevent further considerations of this interesting subject, but the purpose of this article will be served if the reader carries away an impression of fundamental difference between sensitivity and selectivity. The former may be expressed as the ability of a set to bring in stations; the latter is the ability to cut them out.



An unusual "aerial" view. Looking down the centre of one of Rugby's huge masts.

on—but if not, here is the difference in a few words.

Sensitivity is the ability of a set to pick up weak signals from distant stations. In a crystal set, sensitivity is low, and the receiver is generally limited to one or two broadcasting stations, because although the weak signals from other stations are flowing in the aerial, the sensitivity of the set is not high enough to make the weak impulses audible.

Selectivity, on the contrary, is merely sharp tuning. The term means, that what-

signals from ten or a dozen Continental stations. If it has good selectivity, too, it will do so whilst the local station is in operation; but the point not sufficiently realised to-day is that it might be quite sensitive without being selective, or quite selective without being very sensitive.

A Wave-Trap's Limitations.

This latter is one of the reasons why the fitting of a wave-trap is not a success in the case of a listener who confuses selectivity and sensitivity. His set is more selective,

MEASURING RESISTANCES.

(Continued from previous page.)

For the higher resistances a thinner gauge of wire should be used, after measuring the resistance of a length of it. Each length, when calculated and cut off, should be wound on a wooden peg, as in Fig. 4, starting with its middle point and winding it double. This minimises self-inductance, which would affect the accuracy of results. The coil can be bound round with insulating tape, and its two ends soldered to two terminals. All the coils can be mounted on the same ebonite strip, and should be clearly labelled.

As the instrument gives better results when D is near the centre of the metre wire, it is best, when selecting a standard resistance for use, to choose one (or several joined in series) so that its value is, roughly, the same as that of the unknown resistance. Thus a 5-ohm standard would do for measuring the resistance of a filament rheostat.

When making up the standard resistances, it is best to take extra care in measuring the resistance of the length of wire first used, as the accuracy of all the resistances depends on how well this is done. This piece of wire should first be joined in position X, and the relation $X = \frac{10 \text{ ohms} \times BD}{AD}$ used. Then the

positions of the wire and the 10-ohm coil should be interchanged, and the resistance of the wire calculated from the relation

$$X_1 = \frac{10 \times AD}{BD}$$

This result will differ slightly from the other, and the average of the two should be used.

It would, of course, be easier, though more expensive, to purchase all the standards, and the results obtained would undoubtedly be more accurate. It is quite feasible, however, to make a set accurate enough for a wireless experimenter's needs.



The Principles of Wireless Tuning

By Sir Oliver Lodge F.R.S.

In this article, the last of the series, our Scientific Adviser deals with different kinds of receiving aeriels and their function. Further articles by Sir Oliver Lodge will appear in later issues of "P.W."—EDITOR.

The best adjustment of such an aerial varies a good deal with diverse conditions, and is a matter which can be arranged by the designer and con-

structor so as to correspond with the dictates of both theory and experience.

THE primary object of an aerial is the collection of ether waves from the region of space round it comparable to a wave-length. The simplest kind of aerial is a mere collector, an insulated wire extending from the detecting instrument to any convenient height, preferably away from other elevations. Such a wire taps waves in the ether, absorbing their energy; and it was shown by the late Lord Rayleigh that any absorber, whether of light or sound or anything else, no matter how narrow in section, will absorb an amount determined in breadth by one-third the wave-length of the waves received.

Such collectors were used by Hertz, usually in pairs, each component of the pair having a certain capacity—one up, one down. No connection was then made with the earth, because the first thing to be demonstrated was that waves were really received through space, and were not tapped off from the earth or any other conductor. But, as Senatore Marconi found long ago in his experiments in Italy, when the object was not demonstration of waves, but signalling to a distance, connection with earth was advantageous. Indeed, it was always known to be advantageous, but for wave-demonstration purposes it seemed unfair. On the other hand, for signalling purposes the conducting power of the earth is useful, and its utilisation entirely justifiable; hence the Marconi aerial was an elevated wire or capacity earthed at its lower end, and with a coherer inserted in it.

A Famous Patent.

In 1897 Lodge made the aerial continuous from sky to earth, and inserted a self-induction coil in it so that it had a definite tune which could respond to the received waves; and he connected the coherer or other detector not in the aerial but joined to two points in it as a lateral loop, the junctions being one above and one below that self-induction coil, so that after the oscillations had been worked up by resonance to a certain pitch they could overflow through the side branch and stimulate the coherer; or the aerial might be coupled inductively to the coherer through a secondary coil, which could transform and thereby give a higher voltage.

Later, in the Marconi 7777 patent, the tuned aerial was thus coupled to a tuned closed circuit, which responded vigorously and overflowed in the same way through the coherer as a by-path.

This is used to this day, but it has two or three disadvantages. One is that there are two things to be tuned instead of one; another is that coupling two circuits together is apt to cause a double tone and a certain amount of distortion; while the third and chief one is, at least when reaction is employed, that the tuned aerial is liable to become self-excited with additional energy, and thereby act as a re-radiator.

Untuned Aerial.

In the improved arrangement now being referred to I use a tuned closed circuit to stimulate a coherer or crystal or valve. I do not employ a tuned aerial, but use it only as a collector. It is true that an aerial possessing capacity and self-induction must be of some tune—i.e. some natural frequency; but that frequency may be sufficiently removed from anything which it is desired to receive, the waves to which it can respond most easily being either long or shorter than those appropriate to the tuned closed circuit. Such an aerial may be called a choke aerial.

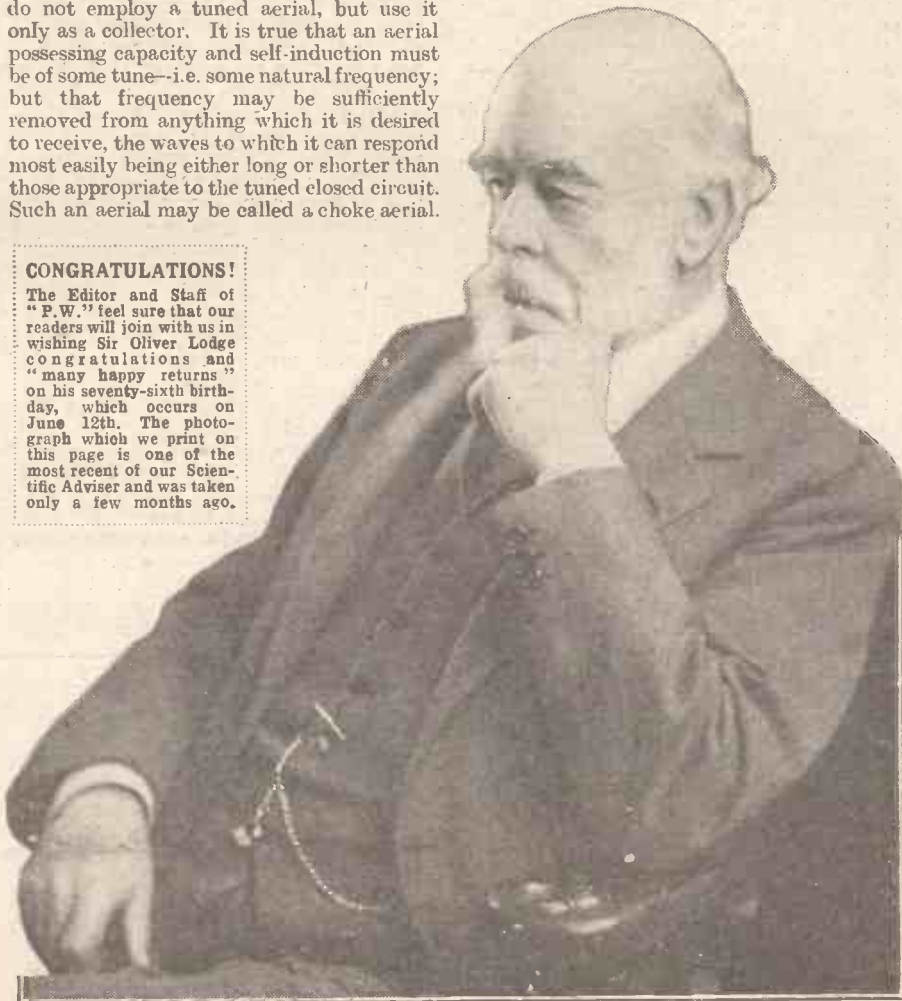
CONGRATULATIONS!

The Editor and Staff of "P.W." feel sure that our readers will join with us in wishing Sir Oliver Lodge congratulations and "many happy returns" on his seventy-sixth birthday, which occurs on June 12th. The photograph which we print on this page is one of the most recent of our Scientific Adviser and was taken only a few months ago.

Theory of the Choke Aerial.

If an aerial is used to stimulate laterally a closed circuit there must be some obstruction in the aerial-earth system, in order to divert some of the energy into the path desired; otherwise the waves will merely surge up and down in the aerial between sky and earth, and not give off any branch or side current or stream of waves in the detector's direction.

(Continued on next page.)



PRINCIPLES OF WIRELESS TUNING.

(Continued from previous page.)

An obstruction introduced into the earthed aerial may be one of three forms; it may be a resistance, or a capacity, or an inductance. If it is a resistance it will dissipate some of the energy and waste it in heat. A resistance can be made so as to allow long waves to go through it more easily than short waves, especially if the resistance is an iron wire; for rapid vibrations keep to the outside of a wire, and accordingly encounter much more obstruction than do vibrations of smaller frequency. There may therefore be an advantage in introducing an iron resistance into an aerial; for it would act as a choke or obstruction, and therefore a useful deflector of very short waves, and yet allow the long waves of atmospheric disturbance to reach the earth without much tendency to side transmission.

Effect of the Choke.

If a capacity is introduced into an aerial its wave-length is considerably shortened, especially if the introduced capacity is small; and by tapping off from such capacity some amount of lateral disturbance can be perceived by the detector, though in the absence of resonance the effect would be small. Moreover, the effect of a capacity is opposite to that of a resistance in that it obstructs the long waves most and the short waves or high frequency least—which presumably in most cases is just not what is wanted.

The third method is a choke coil of high inductance. By this means the natural period of the aerial may be made as long as we please. A choked aerial will not receive the waves quite as freely as a simple conductor, but it will give off laterally a much greater fraction of the received impulses. Waves collected by such an aerial, and finding a by-path, will prefer to take it in fair quantity rather than pass through the choke. Accordingly, though less disturbance is received, a greater fraction is sent off laterally, and a greater fraction of a small quantity may be superior to a small fraction of a large quantity.

Adapting for Long or Short Waves.

The choke of an inductance coil is its impedance, and is practically pL , where L is the inductance of the coil, and $p/2\pi$ is the frequency of the received vibrations. Accordingly, the impedance of a choke is directly proportional to the frequency.

The choke therefore may be too big, especially for high-frequency waves, because they are prevented by the choke from entering it. It may also be too small, especially for desired longer waves, because they will be conducted down to earth through the choke so freely that they will give off very little lateral disturbance, such as is required by the detector. There must therefore be a compromise.

When short waves are wanted, that is when p is big, L must be moderately small. On the other hand, when long waves are wanted—i.e. when p is small, L must be sufficiently big. The whole choke depends on pL , and if one factor is diminished, the other must be increased, in order that the

product may have a reasonable value. In this there is no question of tuning; the coil is acting as a mere choke; and its effect is partly to reduce the amount of energy received, partly to send a greater fraction of it in a desired or lateral direction. Experience readily shows the kind of inductance which must be plugged in for listening to stations comparable with Daventry on the one hand, or comparable with London and Bournemouth on the other, or again, for listening to stations of very short wave-length. The longer the wave the bigger in general must be the effective choke. Occasionally, however, an H.F. aerial is most effective.

A Free Vibrator.

Of course, any such aerial cannot but have a tune of its own, but, as said before, that tune has nothing to do with the problem; it is essential that it be entirely out of tune with what is being received. At first sight it looks as if the need for a big choke for long waves and a small choke for short waves means a kind of tuning; but it will be found that altering the coils, plugging in different coils, makes comparatively little difference. No fine adjustment of any kind is provided, because no tuning is wanted. The aerial is essentially untuned; it is a choke collector.

A choke aerial, therefore, is subject to forced vibrations with which it is not in tune. The theory of such forced vibrations is well known, and was referred to in a previous article.

To determine the amplitude of the received vibrations in the aerial, its natural tone must be taken into account; and when the two tones are entirely different, the theory becomes simple.

It is also possible to calculate the amount of later disturbance available, which really means the alternating potential at the tapping point; and it can be reckoned how that depends upon the whole circumstances of the case.

The N circuit detector may be thought of as stimulated by the alternating potential in the aerial above the choke; or it may be thought of as a by-path which a fraction of the waves take as they come down the aerial, the rest of them pursuing their direct journey to the earth.

It is highly desirable that the N circuit be stimulated only feebly by the aerial; for if it is stimulated too strongly it may be forced to vibrate in response to undesired frequencies. The object of the arrangement is that it shall be stimulated so feebly, through the method of connection adopted, that it can only respond to the vibrations with which it is itself in tune. That is to say, the N circuit is a free vibrator, not forced to vibrate at all, but ready to vibrate easily under exceedingly small stimulus when they are of precisely the right frequency.

The small stimulus can be attained by a device which looks as if it could not possibly work. That is one of the novelties in the N circuit. Another novelty is the slight supply of regenerating power, which is accomplished without any reaction and even without any coupling, by a method introduced by Melinsky, which again at first sight looks as if it could not work.

Theory of Regeneration.

With an untuned aerial the only regeneration possible must act on the tuned N circuit;

and that circuit requires very little regeneration if properly constructed of sufficiently low resistance, for already it is a fairly persistent vibrator. All that regeneration has to do is to supply the energy to replenish the inevitable waste due to its residual resistance, that is to the resistance which cannot be avoided. Such regeneration must be of the right frequency, and must supply extra local energy. All this is furnished by the anode of the valve connected somehow to the H.T. battery.

But if that is in any way coupled to the N circuit the regeneration is far too strong; and when it is too strong it becomes self-exciting and continues the vibrations long after they are wanted. Vibrations in the N circuit must be damped out, so that it may be ready to receive a fresh lot: it must not be a really continuous or persistent vibrator if we are to get clear, distinct signals which do not merge into one another.

This is the object of the dampers in a piano; and when they are raised by the loud pedal then the notes do merge into one another: you get extra loudness but some confusion.

Only Slight Reaction.

We find that sufficient regeneration, and not too much, can be attained by the Melinsky device of earthing the anode, that is virtually of connecting it to the N circuit—if at all—in a very indirect and circuitous manner, partly through the earth and partly through the choke, or rather through the self-contained capacity of the aerial coil; so that all that reaches the N circuit from the anode—which by the magnifying action of the valve is vibrating vigorously at the right frequency—is a mere infinitesimal fraction. This just serves the purpose, maintains the tuning stable and efficient, and has hardly any tendency to real self-excitation. Accordingly it is very difficult to make a circuit, thus provided with an earthed anode, howl. But the coils must be properly designed and arranged.

By establishing too good a connection it is possible to make it howl. If, for instance, the choke coil is inadequate, too much disturbance may reach the N circuit from the earth. With an adequate choke coil, however, this does not happen, and whether it happens or not, it is only the internal circuits in the laboratory which are self-excited. The aerial does not respond; for it is entirely out of tune, and accordingly there is no re-radiation to disturb the neighbours.

Does Not Cause Interference.

When the circuit is in proper order it can hardly be got to howl at all; and when it is purposely put out of order it still does not cause any disturbance except to itself, or within a distance of a few feet. That is the condition we should theoretically expect, and it is confirmed by practice.

Within a quarter-wave-length energy is pulsating to and fro, and within that region interference or overbearing is likely to occur; but beyond that distance where true radiation is being sent out across space no interference is likely, nor can any be found. The complete circuit does not truly radiate; it does not act as a deleterious and undesired transmitter. Neighbours cannot hear it. It is a receiver and a receiver only.



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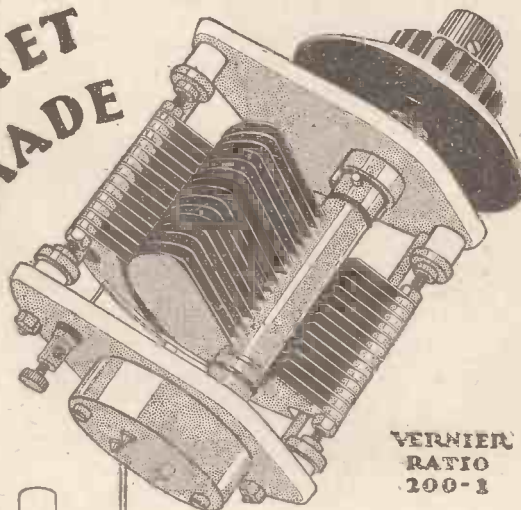
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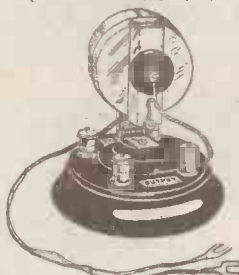
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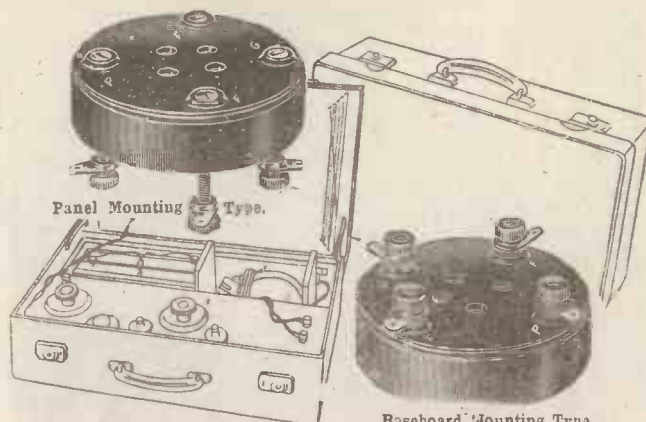
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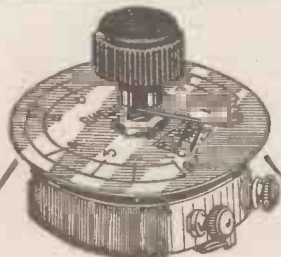
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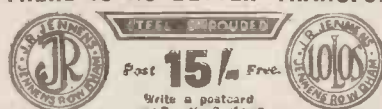
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Design of Portable Sets

By J. ENGLISH.

Portable Sets will be more popular than ever this summer, and in the following article a well-known contributor to "P.W." makes many useful suggestions to potential constructors of Portable Receivers.—THE EDITOR.



PORTABLE receivers will no doubt attract considerably more interest this year than in the past, and manufacturers will certainly have surprises for us in the way of novel and compact sets which will do much to increase their popularity.

The experimenter who intends to construct his own set will perhaps be casting about for ideas for inclusion therein, and it

build a super-het. into the "dickey." It would be well, therefore, to content ourselves with a maximum daylight range of, say, up to ten miles on a small loud speaker and 100 miles on the 'phones, which is well within the capacity of any well-designed two or three valve portable set.

Two Types of Aerial.

A factor that influences considerably the choice of a circuit is the nature of the energy collector, which may be an open aerial or a frame aerial. As the latter is such a poor energy collector relative to the open aerial more valves are required to obtain the same range and volume of signals. Therefore, if we are to design a set of convenient size and weight, provision must be made for the use of an open aerial in order to obtain the maximum range. Also much experience of the demands upon a portable receiver has shown that the ability to use either open or frame aerials is almost a necessity.

In the case of a two-valve set with a frame aerial built into the lid of the case, very good 'phone reception is obtainable, within a radius of five to ten miles of a station of $\frac{1}{2}$ kilowatts power. This usually proves quite satisfactory for town dwellers, but those who journey farther afield have facilities in the countryside for erecting an open aerial which will increase considerably the range and power of the same two-valve receiver.

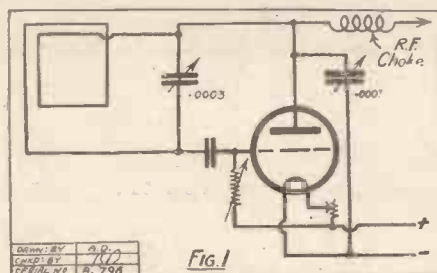
Concerning the Tuning.

The experimenter should decide what he requires from the set, within the limits described above, and then the choice of a suitable circuit will become a much simpler problem. At this stage due consideration given to the following points will do much to make the set a success from every point of view.

Firstly the simpler the tuning arrangements, the better, for although there may be much pleasure in handling a set of many knobs when seated at home on a winter's evening, the same is not the case with summer radio. The less the time spent on setting up the receiver and in tuning in, the more the pleasure. Two tuning controls with one filament rheostat constitute the maximum for an easily operated set, employing perhaps a detector and one or two L.F. valves. The number of L.F. valves will not affect the number of controls, for by using balancing resistances one rheostat

can control the current of three or four valves.

Full advantage must be taken of the benefits of reaction, especially when working with a frame aerial. Reaction control must be perfectly smooth and this fact, in conjunction with economy of space, rules out all methods but capacity control. It is possible to use a variable resistance as a control but, in my opinion, the capacity method is much to be preferred, as it is so constant and reliable and can be adjusted so that the valve is in its most sensitive condition.

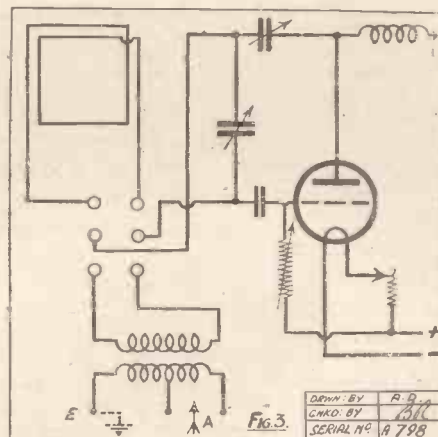
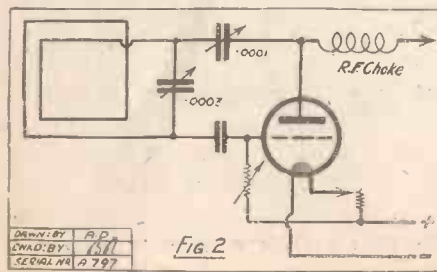


behoves him to consider the design of his receiver at the earliest opportunity, so that there may be ample time for experimenting with various circuits, and deciding upon the final lay-out. Construction can then be completed in good time for the receiver to be ready for the summer months.

The Weight Problem.

Obviously the first consideration in the design of a portable receiver is its portability. Some receivers I have seen, including commercial efforts, must have been designed for the "strong, silent man," for only he could carry such a weight for ten miles on a hot summer's day without a murmur. But most of us want our sets to be entirely self-contained, as light and as compact as possible, not unnecessarily complicated, and capable of giving good service.

As regards range and volume, too much ambition leads to disappointment. My advice to the man who wants to get all the B.B.C. stations on the loud speaker, using a frame aerial, is to buy a two-seater and



As regards the wave-length range of the receiver, again we must control our ambition. The greatest success can only be obtained with a receiver designed for a reasonable wave-length range, because constructional difficulties and the size of the set are only unduly increased if plug-in coils are used to cover all wave-lengths. A range of 150 to 600 metres can be readily obtained with small, fixed coils built into the set, and if capacity reaction control is used, the space occupied by the tuning arrangements can be made very small indeed.

"Straight" Circuits Best.

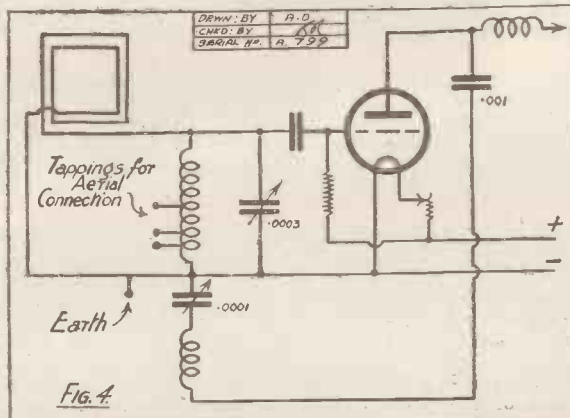
No doubt experimenters have their pet circuits upon which to construct a receiver, but I think all will agree that something more than a "straight" circuit is required, but not necessarily anything freakish. A "straight" circuit will give the very best results when coupled to one's permanent

(Continued on next page.)

DESIGN OF PORTABLE SETS.

(Continued from previous page.)

aerial and earth, but the lay-out of such a set is somewhat bulky. So the "straight" circuit must be "gingered up," and the lay-out reduced considerably before we can make up a good, portable receiver. Experi-



ments on these lines with various well-known circuits will do much to improve the efficiency of the set.

In order to give some idea of the type of circuit which fulfils the above requirements, we can consider the circuits of Figs. 1 and 2. I have used these with great success for short-range receivers, using a frame aerial, for which they are particularly suited, but provision can be made for changing from frame to open aerial as shown in Fig. 3. For sake of simplicity, the detector valve only is shown in Figs. 1 and 2, and one or two L.F. valves can be added in the usual way. Fig. 1 is a modification of the Ultra-audion, and Fig. 2 of the Hartley circuit, both being operated in the same manner.

Reflex Circuits.

Two-valve receivers based on these circuits give very good results at seven miles from 2 L O in conjunction with quite a small frame aerial, and when carefully adjusted, volume is sufficient to operate a small loud speaker.

As regards the constants of these circuits, the frame aerial can be wound on a flat cardboard former contained in the lid of the case, and if this measures 18 in. by 10 in., thirty turns spaced $\frac{1}{4}$ in. will be sufficient. Coils L_1 and L_2 are wound with 24 or 26 D.C.C. as basket or honeycomb coils to economise space. The tuning condenser C_1 need only be .0002 or .0003 mfd. with a reaction condenser C_2 of .0002 mfd. The choke coil can be dispensed with where the self-capacity of the transformer primary is low.

Experimenters have ample scope with circuits using a crystal detector, and some economy of space and weight is effected by dispensing with the detector valve, though, of course, the latter has the advantage over the crystal as regards sensitivity. Reflex circuits need to be designed with particular care, for the tendency towards instability and waywardness becomes marked when a

frame aerial is used. This class of circuit is only suitable for use with an open aerial.

Constructional Details.

An excellent circuit for both frame and open aers is that shown in Fig. 4. This is an adaptation of the Reinartz circuit. The coils L_1 and L_2 are wound on the same former with the usual number of turns as in the ordinary Reinartz receiver. The frame aerial, which should have rather more turns than usually required, is then connected in parallel across the inductance L_1 . This circuit makes a handy two control receiver, and if two L.F. valves are added considerable volume may be obtained at short ranges. By providing tappings on the coil L_1 the receiver can be connected to an open aerial. Under these conditions reception over much greater distances is possible.

Other circuits that have a certain popularity for use in portable receivers are the Armstrong and Flewelling Supers, for which great results are claimed. They are hardly suitable, however, for general use, as it requires some care construction and a good deal of skill before good results are obtained, and even then the quality of signals is disappointing.

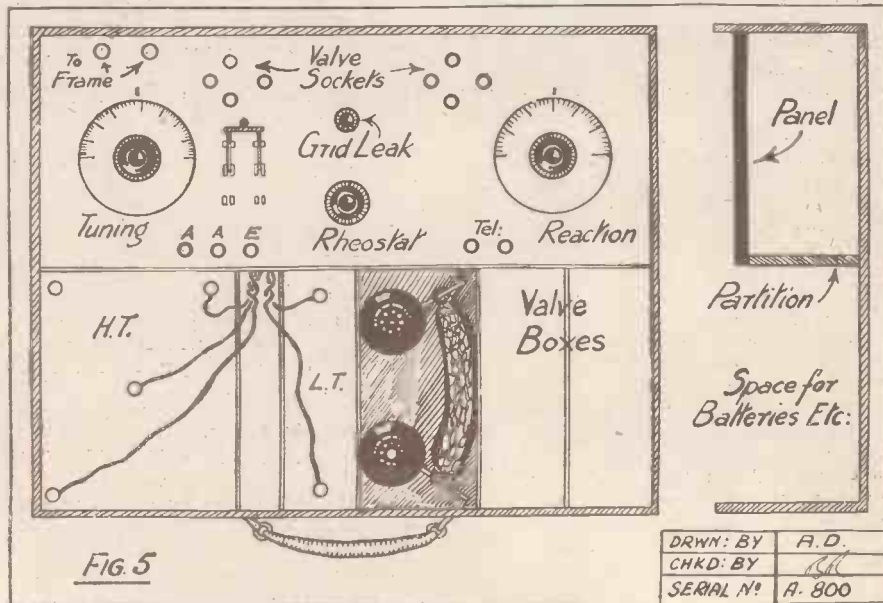
When considering the lay-out and construction of the set, the great thing to aim for is a compact and neat finish. So many portable receivers, and even those due to

Components should be chosen with the view to obtaining the greatest efficiency for the smallest size. Compact low loss coils can be wound with 24 or 26 D.C.C. on cross-shaped formers, and if these are well made a tuning condenser of .0003 mfd. will give an ample tuning range. The tuning capacity in parallel with a frame aerial should be as small as possible for the highest efficiency, and a .0002 mfd. is usually sufficient to cover 200 to 500 metres with a frame of the proper size. The low-frequency stages must be designed to take up the smallest space, and the flat transformers now obtainable help considerably in this direction. Other components deserving mention are valve-holders, which should be anti-phonetic, and the grid leaks, which are useless unless they are truly variable and reliable.

Importance of Lay-out.

If a careful choice of components is made, the depth of space required beneath the panel can be reduced to $3\frac{1}{2}$ inches, and the space above the panel, to clear knobs and terminals, to $1\frac{1}{2}$ or 2 inches. A suggestion for the lay-out of a two-valve set is given in Fig. 5. Here the case is divided lengthways by a wooden partition, forming two compartments, on one of which is mounted the receiver panel, the space in front being used to accommodate batteries, valve boxes and phones.

The system of Fig. 5 can be used successfully for one or two valve sets, and I possess a self-contained two-valve receiver built into a leather case measuring 16 by 11 by $4\frac{1}{2}$ inches, the total weight being 11 pounds, making a very portable outfit.



experts, resemble nothing more than an armful of components thrown into a suitcase. There is no excuse for such an untidy state of affairs, and a little extra care spent over this part of the design will enhance both the appearance and the efficiency of the receiver.

The constructional system that I have used for some time is to make up the receiver proper on an ebonite panel with only the controls, valve holders and terminals visible on top. This panel is mounted in a compartment of its own, and leads brought from it to the battery compartment,

Where three or more valves are to be used the same system would make the set rather too bulky and heavy. We can get over this difficulty by dividing the outfit between two cases. One case can contain, for example, the receiver proper together with a built-in loud speaker and the telephones, while the other case can accommodate the batteries, valve boxes, aerial wire, etc.

Apart from the fact that two small cases are easier to carry than one large one, this system has its advantages because one

(Continued on next page.)

DESIGN OF PORTABLE SETS.

(Continued from previous page.)

seldom goes out alone with a portable outfit, and one can usually persuade another of the party to carry the heavier battery case!

Where the receiver gives sufficient volume to operate a loud speaker, an instrument of convenient size can be carried in the receiver case, as indicated in Fig. 6. There is ample scope here for experimenters to use their ingenuity in building a loud speaker into the case itself, using one or other of the excellent units now sold for that purpose.

The Portable Aerial.

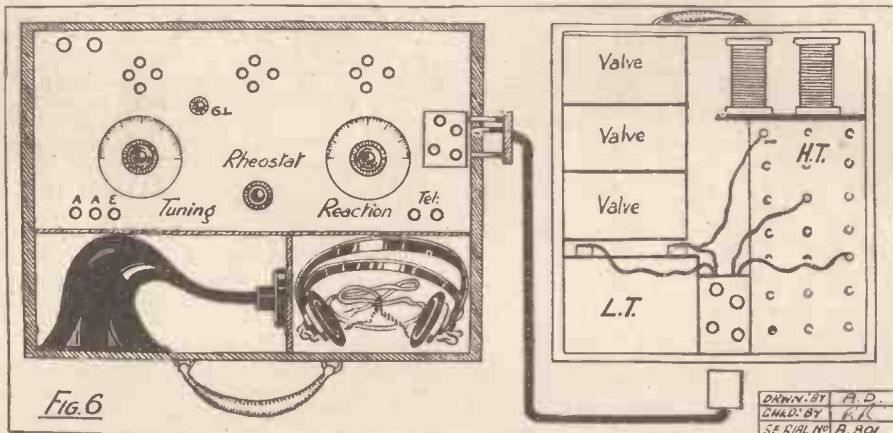
In conclusion a word or two regarding the temporary aerial system may not be out of

place. The best wire to use is rubber-covered stranded cable, which should be as flexible as possible so that it can be wound into a small bulk for carrying purposes. The free end may be thrown over or otherwise attached to a tree as high as conveniently possible, the other end being stayed to the ground near the set. Quite a good aerial can be made by laying a length of wire along a hedge, and almost any wire elevated in some way will serve, provided the insulation is good.

The Earth Connection.

The earth connection may be made by attaching a wire to a metal spike driven into the ground, and several such spikes well spread out make a fairly good earth connection. A more efficient and easily erected earth can be obtained by merely laying a length of rubber-covered wire on the ground in a line immediately beneath the aerial wire.

Such an aerial-earth system serves as a very good energy collector, and will introduce less damping into the tuning circuits of the receiver than would be the case where a direct earth connection is used. When the outfit is packed up the aerial and earth wires are wound on two reels, for which room can be found in the battery case.



Connection between the batteries and the set can be made by a cable of flexible wires fitted at each end with a plug having a suitable number of contacts at each end, say two for L.T. and two for H.T. The connections of the plug sockets in the receiver and battery cases will be obvious. A suggested design for a receiver on these lines is given in Fig. 6.

Dull Emitters Essential.

The experimenter who gives careful attention to the points of design outlined above as applying to his own receiver will have a sound basis upon which to commence construction, and if the usual details are adhered to, constructional work will not be any more difficult than with an ordinary set. Particular care, however, should be given to soldered connections, and any long wires should be anchored in some fashion to prevent vibration and possible contact with other parts of the circuit.

For portable receivers there is really only one suitable class of valve, and that is the .06 amp. dull emitter type. Two or three of these, with a possible fourth valve, a .1 amp. power valve for loud-speaker work, can be run off dry cells. The .06 type take very little anode current, while the anode voltage need not be more than 45 to 50 volts.

The L.T. Supply.

There is no great advantage in using large dry cells for filament current supply, as a reduction in space and weight can be effected if small batteries are used, such as the Ever-Ready No. 126, 4½ volt size. One of these will run a three-valve set for quite a length of time, and as the set will, in most cases, be used but occasionally, this type of battery entails less expense in maintaining an L.T. battery of the correct voltage.

The valves should be carried in the boxes supplied by the makers, as this is a better protection than placing them permanently in the holders of the set.

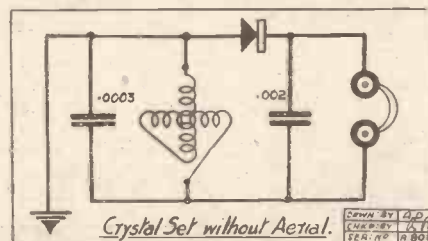
Correspondence

Letters from readers discussing interesting and topical wireless events or recording unusual experiences are always welcomed, but it must be clearly understood that the publication of such does in no way indicate that we associate ourselves with the views expressed by our correspondents, and we cannot accept any responsibility for information given.—Editor.

CRYSTAL SET WITHOUT AERIAL.

To the Editor, POPULAR WIRELESS.

Dear Sir,—I noticed with interest the recent letter of Mr. Farley on crystal reception, and am writing of experiments which I made in a similar direction. About two years ago I had an ordinary cardboard



tube variometer crystal set, which I considered very inefficient. One day I put a fixed condenser, .0003 mfd. in parallel with the variometer, and I found that I could receive 2 L.O. fairly well, using only an earth connection. (See diagram.)

I also tried a variable condenser in place of the fixed one, with no appreciable difference in results.

But I have not been successful without an earth and I suppose Mr. Farley's good results are due to the circuit used—the Ultra. I have tried many of "P.W.'s" famous sets, including the "Chitos" one and two valves, the straight (O—V—1) set. This I use for loud speaker work on 2 L.O. with good results, and occasionally "DX." Using this circuit, I have been able to tune in a number of foreign stations, including what I believe was Bilbao, which I consider very good, as I was using an experimental cardboard panel (shelacked one side) when I received this station. I find the B.B.C. stations difficult to tune in, and I have only received

Bournemouth (100 miles) apart from Daventry and London. Has anybody else noticed this?

Yours truly,

G. L. ASHMAN.

22, Kentish Town Road, N.W.1.

A ONE-VALVE "MARVEL."

To the Editor, POPULAR WIRELESS.

Dear Sir,—I would much like to know what my fellow-readers think of the following circuit which I have just chanced upon.

With the aid of a loud speaker, volume is exceedingly great, but the set must be tuned carefully, otherwise it can be rather fierce.

Parts used in the hook-up included

Two-way coil holder (cam vernier).

Variable condensers with verniers.

D.E. 6 power valve (Marconi).

Brown's H.Q. speaker, 4,000 v.

Finston Lo-loss coils, Nos. 50 and 75, and so forth.

When tuning in local transmissions coils should be left at 90° apart, but in order to obtain best results the set must be on the verge of oscillation.

It will be found to be a very "sharp" super to manage.

I trust the circuit will be of interest to some of my fellow-readers.

With best wishes,

Yours faithfully,

G. C. COLLINS.

91, Hargrave Park, Highgate, N.19.

BLUE PRINT APPRECIATION.

The Editor, POPULAR WIRELESS.

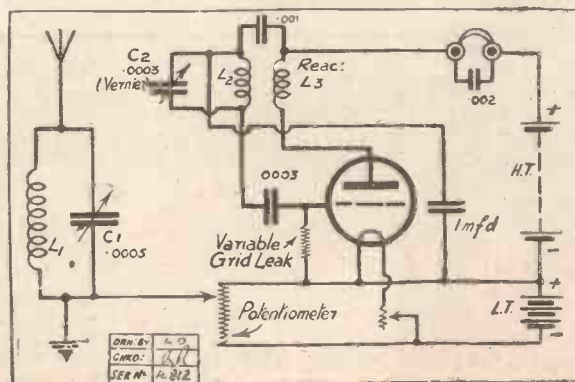
Dear Sir,—I feel I must write you a few lines to tell you what excellent results I have obtained with your Gd. blue print No. 19 (H.F., Det. and L.F.).

I have built a good many three-valve sets, but this beats the lot.

Yours faithfully,

A. T. B.

Durban.



HOW BROADCASTING AFFECTS THE THEATRE.

An Interview with George Grossmith, the Famous Actor-manager.

By "ARIEL."

WHEN I entered the comfortably furnished dressing-room of Mr. George Grossmith at the Palace Theatre, the curtain had rung down on the last act of "No No Nanette." The applause had not ended when Mr. Grossmith threw himself into a deep arm-chair and pushed over the box of cigarettes.

"I have never considered the theatre a rival to broadcasting," said Mr. Grossmith, beginning to remove his make-up. "On the contrary, I think it is its most powerful ally. If broadcasting had not the assistance of the theatre, it would not be the great success it is to-day.

"The theatre is to broadcasting what music is to the cinema. Its value, while not entirely indispensable, is indisputable. A film can be seen without musical accompaniment, and can still be understood. Broadcasting without the aid of the theatre is still an entertainment, but with it its interest has increased a thousandfold."

Mr. Grossmith is of the opinion that the theatre should be more closely allied with wireless broadcasting.

"Broadcasting," he went on, "is just as valuable to the theatre as the theatre is to broadcasting. As an advertising medium, I consider radio equal to none. We have proved it time after time.

Beneficial Effects.

"When we broadcast excerpts of 'No No Nanette!' the receipts, always very good, surpassed all previous weeks of a period when Theatreland was doing none too well.

"It has been the same with many plays which were not doing well. Broadcasting of excerpts, or even full acts, of

plays and musical shows has been most beneficial from the box-office point of view."

Mr. Grossmith went on to explain that, following broadcasting of a theatrical show, the management had received large numbers of letters booking seats from people who lived many miles away and had listened in the previous day.

"I may say that in broadcasting every day in every way we endeavour to better our programmes, and if one were to judge by the thousands of letters we receive at Savoy Hill, I might say that our large, unseen audience agree with us."

One of the most difficult tasks in the world is to arrange wireless programmes, and Mr. Grossmith, while more than fully occupied by his acting and managerial activities, finds time to try and please his public.

"Strictest Discrimination."

"It is no easy matter to choose suitable items for our programmes," he said. "While some items will please some people, they might offend others. Therefore the strictest discrimination has to be used when the programmes are made up. There are some artistes who will raise the roof at a small theatre, and who would mean nothing to the million radio listeners.

"Hundreds of plays are unsuitable for broadcasting. The dialogue without the acting means nothing, and there are so many characters in a scene that the result over the wireless would be a pitiful embroglio that never could be unravelled.

"Personally, I shall never tire of listening to musical plays and music on the wireless. I have two sets, one at home and this one here at the theatre. Both afford me great entertainment.

"When I have an hour to spare, I find wireless a great relaxation; and the more I listen-in, the more I like it.

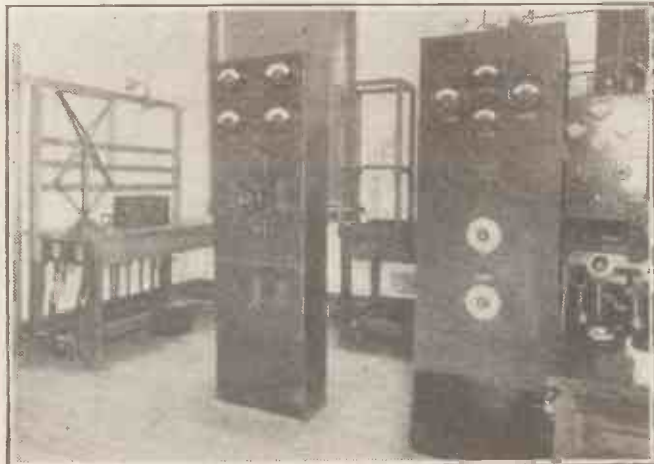
"Beside the millions of radio enthusiasts, there are still some who dislike wireless, and fail to see its possibilities. But wireless, despite its many faults, has brought the sunshine into many homes and made many an unhappy being happy.

"A world without wireless would be very dull, indeed."

And Mr. Grossmith turned on his handsome set. We heard:

"The Savoy Orpheans have just played 'Valencia.'"

We sighed, and then—we laughed.



The control panels of a famous American broadcasting station, W H A Z, which transmits on 380 metres.

"I am glad to see POPULAR WIRELESS has come to pay me a visit," said Mr. Grossmith, with a glimpse of that prominent and attractive smile of his. "I often read your journal, and I like it very much. Now, let's listen to a little broadcasting."

He placed a neat brown attaché-case on the dressing-table in front of us. In a second it was open, and revealed an ingenious three-valve set and loud speaker complete. Mr. Grossmith touched a switch.

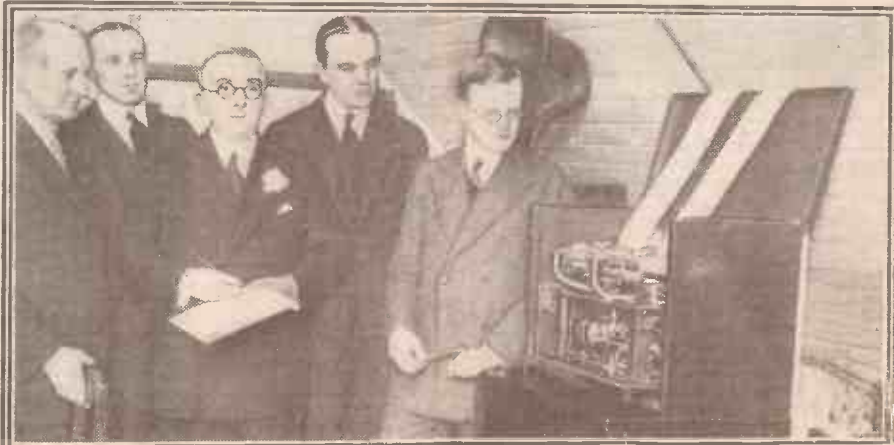
Making Up Programmes.

"The Savoy Orpheans have just played 'Oh, Lady, Be Good!'" Then again the rhapsody of sound, the everlasting battle of the saxophone against drums, the voice of Ramon Newton crooning a love lullaby, the hum of a busy hotel, a thousand feet a-tingling.

Mr. Grossmith switched it off, and the dressing-room regained its silence. We lit cigarettes.

This well-known actor takes a most active interest in broadcasting, and is a member of the advisory board of the British Broadcasting Company. He goes to Savoy Hill once a week, where the programmes are submitted for his criticism.

A conference lasting several hours takes place in which all questions relating to the B.B.C. programmes are meticulously gone into. Suggestions are made on either side as to forthcoming attractions, and Mr. Grossmith's advice is asked on all matters relating to the theatre and "legitimate" entertainment.



The American Ambassador, third from left, watching a demonstration of the transmission of photographs by wireless. The inventor, Capt. Ranger, is standing next to the transmitter.

No unnecessary handling with the "Lotus"

Moving Block cannot fall:

The fewer adjustments, the easier it is to get accuracy. The "Lotus" is designed and proved in actual tests to respond to the most delicate operation without the exasperation caused by ordinary coil holders. The moving block remains rigidly in position with the heaviest coil and no screws are needed to tighten it. It also moves in the same direction as the knob, which prevents any confusion. Three sets of enclosed precision machine cut gears ensure this.

LOTUS VERNIER COIL HOLDERS

From all Radio Dealers.

Two Types:

For outside panel mounting:

Two-way .. 7/-

Three-way .. 10/6

For inside baseboard mounting, with 6 in. handle:

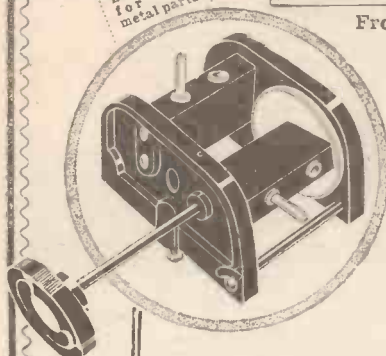
Two-way .. 8/-

Three-way .. 12/6

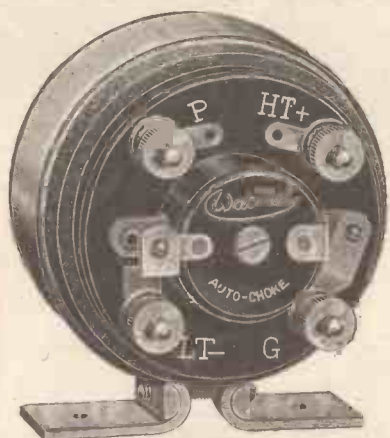
Garnett, Whiteley & Co., Ltd.,

Lotus Works, Broadgreen Road, Liverpool

Makers of the new improved "LOTUS" Valve Holder.



Bakelite mouldings for the side plates, coil blocks and knobs; heavy nickel plating for the metal parts.



".... we might be in the studio"—

will be no uncommon remark now the Watmel Auto-Choke has come into being. Never before has there been such an amplifying instrument. Though building up whispers into voluminous sound, never does it sacrifice tone for volume. The

secret lies in the patent core and specially balanced windings. Ask your Dealer for a demonstration and send to us for descriptive booklet—"Straight as a die." Complete with condenser and fixed resistance. Bright parts heavily nickelled. Price 18/6.

Watmel

AUTO-CHOKE

THE WATMEL WIRELESS CO., LTD., 332a Goswell Rd., London, E.C.1

Telephone: 7990 CLERKENWELL.

Lancashire and Cheshire Representative:

Mr. J. B. LEVEE, 23, HARTLEY ST., LEVENSHULME, MANCHESTER. Telephone: 475 Heaton Moor.

Figures to Remember



The Paper Boy

"Evening Papers—

Evening Papers!"

The lusty shouts of the Paper Boy re-echo through the streets as he hurries up one, and down the next, whetting an appetite for the latest news.

The leading wireless journals of to-day have endorsed in the strongest of terms the claims of Six-Sixty Valves—in fact, our simple statements are modest compared with the "exceptionally good results" obtained.

For the radio enthusiast who uses a small or medium-sized Loud Speaker, we can confidently recommend the S.S.2 L.F. (green disc). For real purity of tone this valve is second to none, and in addition to its low current consumption—only .3 amps—it works at such a low temperature that the life of the Valve is immeasurably increased.

Then there's the S.S.7—a real Power Valve, combining a wonderful purity of tone with unequalled volume, and consuming only .1 amps filament current. With this valve there is absolutely no glow whatever from the filament when operating at the correct voltage, indeed there is no valve that can boast of a longer life because there is no valve that operates at a lower temperature.



S.S.2 L.F.
(Green Disc).

Voltage 2.0 volts.

Consumption .3 amps.

PRICE 14/-

Leaflet S.S. 1.7. gives full particulars. Your Dealer will be pleased to order Six - Sixty Valves for you if he is out of stock.



SIX-SIXTY VALVES

Better by Six times Sixty

The Electron Co., Ltd., Triumph House, 189, Regent Street, London, W.1. 9

A LOW LOSS ALL-WAVE-LENGTH COIL.

By T. W. WHITE.

THE writer has been experimenting with different kinds of low-loss coils recently. These coils usually were very large and often very tedious to make. He had coils for the B.B.C. stations and coils for the very low wave-lengths used by American stations and British amateurs, and usually used a loose-coupled circuit.

their centres for fixing the finished coil to the stand. Next are cut four strips of ebonite as shown in Fig. 1 (b), the slots being spaced very carefully.

Mounting the Coils.

Holes are drilled in these strips at positions marked in drawing, and are then secured to the three supporting blocks by means of small brass screws. The wooden supports can be coated with shellac before doing this, although it is not necessary. The position of the strips on the blocks is clearly seen in Figs. 2 and 3.

The winding of the coil can now be commenced. Sixty turns of bare copper wire (about 16 gauge) are wound on a temporary former 3½ in. in diameter. Take care to wind the wire tightly and evenly and see that there are

no kinks in it. This done the remainder of the wire can be cut away. Now let the coil gradually untwist itself off this former and carefully transfer it to the proper former, lifting each turn into its slot and gathering up any slack as you go along. The ends of the coil are fixed each in two holes, as shown in (Fig 2 A).

The aerial coil can be started now. Four strips of ebonite are cut as shown in Fig. 1 (c). Holes are drilled at each end for securing the ends of the coil. Thirty

turns of the same wire are wound on a 4 in. former and then taken off as before and slipped over the secondary coil. The ebonite strips are put into position about seven turns from the end of the coil, and the aerial coil fixed as was the secondary coil as shown in Figs. 2 and 3. The ebonite strips will be kept upright by the tension put on the wire when fixing the aerial coil.

The coils have now to be tapped with some thin brass strip about ¼ in. wide. The strip terminals taken from flashlamp batteries are ideal. Cut 8 pieces ¾ in. long, one piece 1 in. long, and one piece 2½ in. long. These can be tinned all over so as to provide better connection with the clips. These are now soldered to the coils. The ¾ in. strips being soldered first in the positions shown in Fig. 3 (a), and Fig. 2 (c).

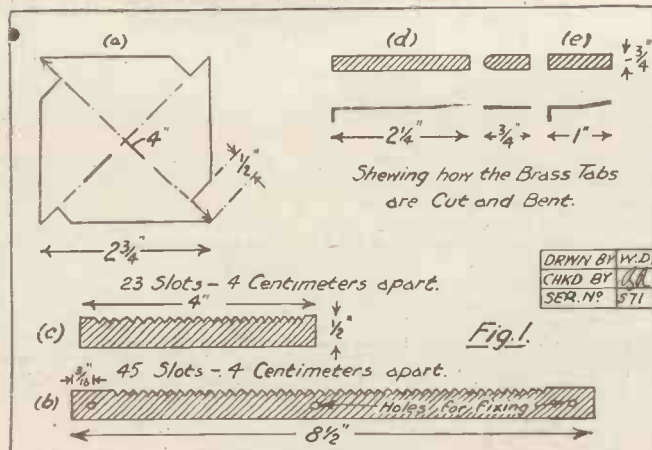


Fig. 1

It was not long, however, before he tried to make a coil which would be low loss and could be used for all requirements.

The coil constructed was really two coils, an aerial coil and a secondary coil with a fixed coupling, and each coil being tapped for different couplings and wave-lengths.

The construction is as follows.

Three pieces of wood 2½ in. square are cut and the corners sawn away with a small saw to dimensions given in Fig. 1 (e). Two of these are fitted with small terminals in

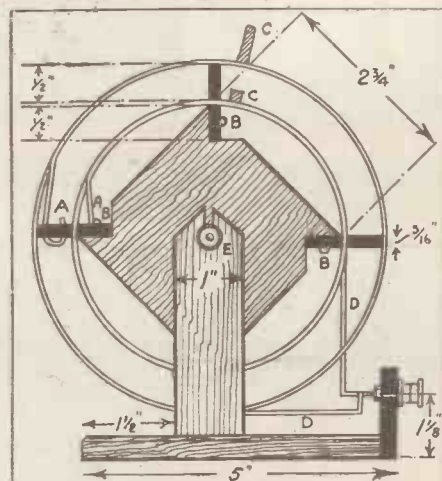


Fig. 2. END VIEW OF COIL.

- A. End of Wire fixed through holes in Ebonite.
- B. Screws securing Ebonite Strips.
- C. Tappings.
- D. Wires connecting Coils to Terminals.
- E. Terminal for fixing Coil on Stand.

DRWN BY W.D. CHKD BY R.R. SER. NO. 569

The 2½ in. strip is next bent into shape, as Fig. 1 (a), and soldered to the centre of the secondary coil. This is done with a small iron by springing one or two turns of aerial coil to one side for a moment, putting them back when the soldering is completed. The 1 in. strip is bent as Fig. 1 (e), and soldered to the coil at the eleventh turn from the end in the same way. The coil is now complete.

Connecting Up.

All that remains to be done now is to make the stand and connect up the coil.

All dimensions for the stand and terminal strip can be seen in Figs. 2 and 3. The ebonite strip is fitted with four terminals. The terminals are connected as follows: A. 1 to beginning of aerial coil; A. 2 has about 9 in. of flex attached to it; B. 3 is fitted with the same amount of flex and B. 4 is connected to the beginning of the secondary coil as Fig. 3. The stand can be coated with shellac to match the other wood used.

In use the aerial is connected to terminal A. 1, the earth to A. 2, the L.T. - lead from the set to B. 3, and the lead from the grid to B. 4.

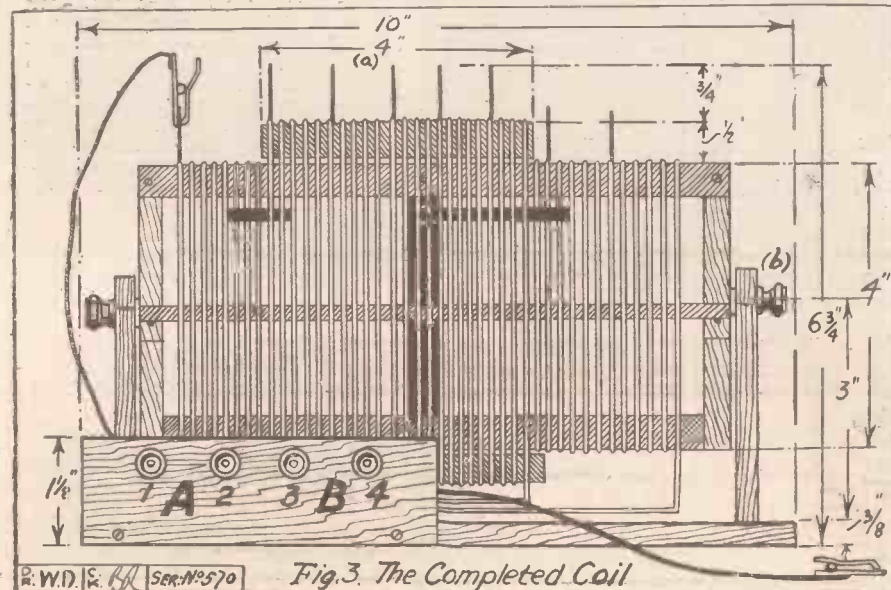


Fig. 3. The Completed Coil

R.W.D. CHKD BY R.R. SER. NO. 570



FILAMENT RHEOSTATS AND POTENTIOMETERS

With the windings carried on a porcelain bobbin and having the contact arm moving on its inner side, the "Cosmos" Filament Rheostat takes up remarkably little space, is strong in construction, and has a very smooth and reliable movement. It is fixed by ONE HOLE, and is provided with a handsome knob and dial. Made in four types, two of which are double wound for Dull or Bright Valves, and one a Potentiometer, the prices are given in an adjacent panel.

METRO-VICK SUPPLIES, LTD.
(Proprietors: Metropolitan-Vickers Electrical Co., Ltd.),
Metro-Vick House, 145, Charing Cross Rd., London, W.C.2

Description	Ohms	Carrying Current	Price
Single Wound	6'0	1'0 amp.	s. d. 4 6
Double "	18+2	4-1'5	5 0
Double "	30+4	2-1'0	5 0
Potentiometer	300	—	6 0

Cosmos

RADIO COMPONENTS

R
P 40.

"Utility" No Capacity Change-over Switches are Cheaper NOW!

These famous switches will now cost you less. 'Utility' quality has not been sacrificed in any way and the 'Utility' guarantee to replace or repair any defective 'Utility' Component free of charge still holds good. 'Utility' No Capacity Change-over Switches are available in six sizes changing over from one to six poles. Loss has been practically eliminated and contacts are permanently self-cleaning.



New Prices.

KNOB PATTERN.
130/1 3/- 130/4 5/-
130/2 3/6 130/5 6/-
130/3 4/6 130/6 7/-
Nickel Plated 3d. each extra.

LEVER PATTERN.
147/1 3/6 147/4 6/6
147/2 4/- 147/5 8/-
147/3 5/- 147/6 8/-
Nickel Plated 6d. each extra.

Wilkins & Wright Ltd.,
Utility Wks., Kenyon St.
BIRMINGHAM

Utility

GUARANTEED COMPONENTS

1/2d
per day
for keeping your
accumulator charged
For A.C. use only.



ONE halfpenny per day for keeping your accumulator charged—even if you own a five-valve set. That is how little it costs you with a Rectalloy Charger. And here is how it is done. The Rectalloy Charger is coupled permanently (a) to your Set, (b) to your Accumulator. (c) to the electric light socket. When you wish to use your set, the switch on the Charger automatically cuts out the Charger and brings the Accumulator in circuit. After the Broad-

casting is over reversing the switch disconnects the Set and immediately sets the Rectalloy Charger charging up your Accumulator.

No mess, no worry, no expense. You can forget your Accumulator exists—for the Rectalloy Charger keeps it perpetually at concert pitch.

A new model is now available for charging H.T. Accumulators. It is just as simple to use and has nothing to go wrong. No moving parts, no rectifying valves, nothing to require replacement.

Model A for a.c. voltage between 100 and 120 65/-
Model B for a.c. voltage between 200 and 250 65/-
Model C for recharging H.T. accumulators from a.c. mains 90/-

All 40 to 60 cycles.
Write for Folder 'P.S.' post free

RECTALLOY

The ideal Battery charger

Rectalloy Ltd., Vulcan House, Ludgate Hill, London, E.C.4.



Apparatus Tested

Traders and manufacturers are invited to submit wireless sets and components to the "P.W." Technical Dept. for test. All tests are carried out with strict impartiality in the "P.W." Test Room under the supervision of the Technical Editor, and the general reader is asked to note that this weekly article is also intended to provide a reliable and unbiased guide as to what to buy and what to avoid. —EDITOR.

THE TUNGSTONE ACCUMULATOR.

A MATEURS who are fortunate enough to own motor-cars need not worry about accumulator charging during the summer. Current can be tapped off from the dashboard to supply portable sets, while, if a "Tungstone" accumulator is used, a cell or two can be removed for running a "household" receiver when the car is in the garage. Better still, extra cells can be purchased and interchanged with those on the "auto." During summer months the car accumulator is not called upon to do much work, so the foregoing is an economical proposition. The "Tungstone," a product of the Tungstone Accumulator Co., Ltd., of 3, St. Bride's House, Salisbury Square, London, E.C.4, is eminently suitable for the purpose; as its cells can be detached with the greatest of ease. As a matter of fact, the plates themselves can be removed from an individual

cell in a few minutes. And this is but one of the many unique features of the Tungstone Accumulator. Its design throughout, from the construction and composition of its plates to its patent "Vislock" terminal locknuts, is a triumph of thoughtful attention to both details as well as essentials.

We have had a 6-volt "Tungstone" in use on a car for a period of about six months, and six months, moreover, of mainly hard winter work. The self-starter must have been used thousands of times, frequently on very cold mornings, and on one occasion the car was driven a distance of over 100 yards on the starter motor. Additionally, the accumulator has been used for wireless work as well, and yet, when recently we examined its plates, no signs of deterioration were in evidence. Our previous accumulator accumulated a deposit of "mud" half an inch in thickness

after a similar period of not quite such hard usage, but the "Tungstone" did not need washing out. It is still in commission, and no doubt will remain at work for many years.

The Tungstone people supply an H.T. battery of 60 volts, at £5 15s., in a polished teak case. The price includes a partial first charge and an acid-resisting metal filler. Readers interested should send for illustrative literature concerning this and other Tungstone batteries. We have not sufficient space at our disposal to describe these products in the detail they deserve. It will be noticed that the manufacturers fill a full-page "P.W." advertisement, and end up with a similar sort of indication!

A BRETWOOD COIL HOLDER.

We recently received a Bretwood coil-holder for test from Messrs Bretwood Ltd., 12-18, London Mews, Maple Street, London, W. It is somewhat similar in design to the Bretwood anti-capacity valve holder, and can be mounted on either a panel or base-board. It is provided with a removable plug and each of its two sockets is fitted with a ball-spring device. Thus the plug can be changed over in a second. This is a neat and quick method of carrying out the reversing of connections, although in a single coil holder it is difficult to see any real advantage in this.

However, the Bretwood component is a well-made little article, and is supplied with stout soldering tags and screws. A brass bush is fitted to take the central mounting screw. It is reasonably priced at 1s. 3d.

EDISON BELL RADIO

SEE HOW MUCH YOU
SAVE BY PURCHASING—

SPECIFICATION

Size 12 x 10 x 10 in. deep, ebonite panel with nickel-plated fittings. Handsome cabinet, desk pattern, highly polished.

This is a very efficient 2-Valve Set and will give good Loud Speaker results at 25 to 30 miles, it having one Detector and one Low Frequency Stage.

It is built into a desk pattern cabinet, enabling it to be closed when desired. Reaction is controlled by moving the side of the cabinet on a nickel-plated arm, which can be locked in any position.

Supplied complete with Coils from 300 to 500 metres. Coils for the high power station at additional cost.

Price - £3 : 15 : 0

(Valves, Batteries and Marconi Licence extra.)



—AN EDISON BELL
"BIJOU" 2-VALVE SET

Loud-Speaker
results
30 MILES

Read this extract from
Radio Press Test:—

"With a very inefficient indoor aerial we obtained full loud speaker strength, etc., and the makers' claim 'loud speaker results 30 miles' is well substantiated."

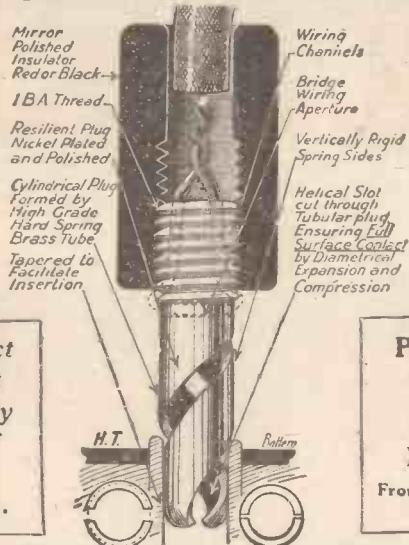
Price - £3 : 15 : 0

(Valves, Batteries and Marconi Licence extra.)

Manufactured by the ALL-BRITISH FIRM with OVER THIRTY YEARS' REPUTATION for QUALITY.

EDISON BELL LTD., Edison Bell Works, LONDON, S.E.15, and at HUNTINGDON.

THE ONLY WAY— Scrap your old junk and fit—



A perfect fitment for every type of H.T. Battery.

PRICE :
2D.
EACH

From all traders or direct.

CLIX WANDER-PLUGS (NON-MICROPHONIC)

90% of the efficiency of a soldered joint.
For all other connections use CLIX plugsockets and adaptors.

From all traders or direct from:

AUTOVEYORS LTD., 84 VICTORIA STREET, LONDON, S.W.1

On Guard!

There is no leakage with a "Lotus" Buoyancy Valve Holder on guard.

Immediate and lasting connection made when valve pins enter valve sockets. The leg socket expands and automatically locks.

Absorbs shock, protects the valves and eliminates all microphonic noises.

LOTUS BUOYANCY VALVE HOLDER ANTI-MICROPHONIC

Made from best bakelite moulding with springs of nickel silver and phosphor bronze valve sockets.

Garnett, Whiteley & Co., Ltd.
Lotus Works, Broadgreen Road,
LIVERPOOL.

Makers of the famous "Lotus" Vernier Coil Holder.



Without
Terminals
2/3

With
Terminals
2/6

3/- does it!

Once and for ever



Pack up all your crystal troubles and forget them. Fit a Brownie Wireless "Permator" to your set—the crystal detector that is always "ever set." After the initial outlay of 3/- you have no further expense or trouble. Simply make sure you have it adjusted to give the loudest signals (and loud they will be, too), and in months to come, no matter what rough handling the set may get, the adjustment will not have varied a fraction of an inch. It is extraordinarily stable, this Brownie "Permator." The whole secret is in its unique spring construction and its two super-sensitive crystals. Each Brownie "Permator" carries the Brownie Wireless Guarantee—"the guarantee that counts."

For trouble-free crystal reception use THE "PERMATOR" the always "ever-set" crystal detector.

Built by the makers of the famous "Brownie Wireless" Crystal Receiver.

THE BROWNIE WIRELESS CO.
(of Great Britain), LTD.

(Incorporating the J.W.B. Wireless Co.)

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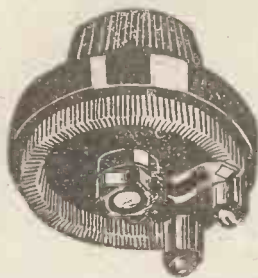
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RADIOTORIAL

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The Editor will be pleased to consider articles and photographs dealing with all subjects appertaining to wireless work. The Editor cannot accept responsibility for manuscripts and photos. Every care will be taken to return MSS. not accepted for publication. A stamped and addressed envelope must be sent with every article. All inquiries concerning advertising rates, etc., to be addressed to the Sole Agents, Messrs. John H. Lile, Ltd., 4, Ludgate Circus, London, E.C.4.

As much of the information given in the columns of this paper concerns the most recent developments in the Radio world, some of the arrangements and specialities described may be the subject of Letters Patent, and the amateur and the trader would be well advised to obtain permission of the patentees to use the patent's before doing so.

Readers' letters dealing with patent questions, if sent to the Editor, will be forwarded to our own patent advisers, where every facility and help will be afforded to readers. The envelope should be clearly marked "Patent Advice."

TECHNICAL QUERIES.

Letters should be addressed to: Technical Query Dept., "Popular Wireless," The Fleetway House, Farringdon Street, London, E.C.4. They should be written on one side of the paper only, and MUST be accompanied by a stamped addressed envelope.

Queries should be asked in the form of the numbered questions: (1), (2), (3), etc., but may be accompanied by a short letter giving any necessary additional particulars as briefly as possible.

For every question asked a fee of 6d. should be enclosed. A copy of the numbered questions should be kept, so that the replies may be given under the numbers. (It is not possible to reproduce the question in the answer.)

BLUE PRINTS. A series of 20 Blue Prints can be obtained from the Query Dept., price 6d. per Blue Print.

Only a limited number of circuits are covered by this series, and full details of the circuit arrangements available in Blue-Print form are published fortnightly in the advertisement columns of this journal.

All other back-of-panel diagrams are specially drawn up to suit the requirements of individual readers at the following rates: Crystal Sets, 6d. One-Valve Sets, 6d. One-Valve and Crystal (Reflex), 1s. Two-Valve and Crystal (Reflex), 1s. Two-valve Sets, 1s. Three-Valve Sets, 1s. Three-Valve and Crystal (Reflex), 1s. 6d. Four-Valve Sets, 1s. 6d. Multi-Valve Sets (straight circuits), 1s. 6d. Except SUPER-HETERODYNE DIAGRAMS, all of which, irrespective of number of Valves used, are 2s. 6d.

If a panel lay-out or list of point-to-point connections is required, an additional fee of 1s. must be enclosed.

Wiring diagrams of commercial apparatus, such as sets of any particular manufacture, etc., cannot be supplied. (Such particulars can only be obtained from the makers.)

Readers may submit their own diagrams, etc., for correction or for criticism. The fee is 1/- per diagram, and these should be large, and as clear as possible.

No questions can be answered by 'phone.

Remittances should be in the form of Postal Orders.

Questions and Answers

ONE VALVE AMPLIFIER.

B. M. E. (Baddesley Ensor).—I have a crystal set giving good 'phone results, but as one of my family is rather deaf, I wish to strengthen it. I am told I want a one-valve amplifier, and I should like to try and make it myself, if it is quite easy. (I can solder all right, but the only set I have made before is the crystal set.) Do you think I could make the amplifier successfully, and if so where can I obtain the how-to-make directions?

All you need in the way of instruction is given on the "P.W." sixpenny Blue Print No. 3, which can be obtained from the Queries Dept. The construction of the amplifier is simplicity itself, and we have no doubt that it will be a complete success.

UNCONTROLLABILITY.

N. M. J. (Bishop's Auckland, Co. Durham).—My receiver is the "P.W." 4-valve set (H.F., dot., and 2 L.F.), which was described in "P.W." 173. Using British valves, it gave excellent results, but recently I purchased a foreign valve for the H.F., since when it has a tendency to oscillate. This causes slight distortion on most stations, even when the H.T. for first three valves is as low as 30 volts. I have tried varying the grid-leak connections, but the fault still remains. What is the best remedy?

As the H.F. valve is coupled to the detector-valve by an H.F. transformer, it will be quite an easy matter to neutrodynise this. When properly adjusted, the trouble will completely disappear.

DULL-EMITTER VALVES.

S. E. D. (Harrow-on-the-Hill).—How are the filaments of dull-emitter valves made?

The filaments are made of "Thoriated Tungsten," which is a solution of Thorium in Tungsten. Thorium is a metal which has a very high specific value of thermionic emission, several thousand times as much as that of Tungsten at 1,700 degrees C.

Only a very small quantity of thorium is used, generally of the order of one per cent. If the filament is heated to a suitable temperature it nevertheless presents a surface of pure thorium, owing to the diffusion of thorium from the interior to the surface of the filament.

Thus the Thorium surface, which is the form of a very thin film, causes a considerable increase of electron emission.

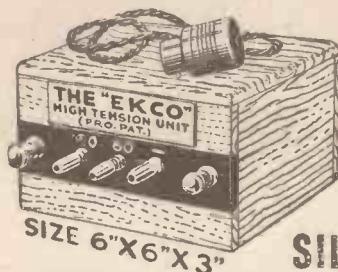
WHAT IS FADING?

"D.X." (Brierley Hill, Worcestershire).—I have noticed when trying to tune in different stations that at times the signals vary in strength, even when no alteration is made to the adjustments of my set. I am told that this is "fading." What is the cause of it?

Fading is often due to the electrical properties of the earth's atmosphere, which vary greatly with height.

(Continued on page 564.)

→ SCRAP H.T. BATTERIES! ←



Derives H.T. from the mains (D.C.) by just attaching adaptor to electric light lamp-holder!

SAFE!
SILENT! SOUND!

Extract from TEST REPORT in
"POPULAR WIRELESS," May 29th, 1926

"Very satisfactory results indeed were obtained, and the 'hum' usually associated with such devices was so faint as to be unnoticeable on a loud speaker. A voltmeter test showed that the marked voltages were substantially accurate and the consumption of current as indicated by a milliammeter was but 7 milliamperes. Thus the cost of running the unit constantly for a whole year would amount to but a penny or two and even dull emitters could not be burnt out were H.T. and L.T. connections deliberately reversed. The 'EKCO' is the most satisfactory H.T. Unit we have yet had brought to our notice, and can be fully recommended to the attention of all readers."

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We guarantee you good results

THOUSANDS of "P.W." readers have benefited by the unique PILOT service for home constructors, and are now the proud owners of handsome and efficient sets, superior to many factory built ones costing three times as much. Briefly, the scheme is this—We supply you with

all the parts for any of the "P.W." or other well-known receivers, together with a panel correctly drilled and neatly engraved, and cabinet to fit. You mount the components and wire up according to the simple diagram supplied. Failure is impossible, but if you encounter any small difficulties, our Service Department will advise you free of charge.



Here is a typical Pilot Set:

The
"P.W." Simplified
I-Valve Reflex

In this handsome little set, one valve does the work of two, and under reasonably good conditions has a range of 600-800 miles on headphones and will give good loud-speaker results up to 5 miles from a main station.

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Polished Mahogany Cabinet **4/6**

There is a PILOT Set for every purpose!

If you want anything from a crystal set to a seven super-heterodyne—which gives thirty stations on the loud speaker—you can build it yourself under the PILOT

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Details of the three splendid sets described in this "Best Way" Wireless Guide are given below. The book is amply illustrated with photographs and diagrams, and constructors will find the wiring directions most lucid and straightforward.

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A remarkably compact six valve SUPER-HET. Aerial, batteries and loudspeaker all completely enclosed and permanently connected. This receiver will appeal strongly to motorists, Caravanners, River Parties, and seaside Bungalow inhabitants.

A Three-Valve Portable

Several stations on the loudspeaker and many on Telephone receivers can be obtained with this receiver. It employs a frame aerial which is built into the lid of its neat carrying case. It will prove popular among Motor Cyclists and other Road and River Tourists.

The Baby Portable

A two valve receiver contained in a very small attache case. Batteries and telephone receivers are enclosed and a reel of wire and earth pin for erecting temporary aeriels are provided. This is the set for the Cyclist Holiday Tourer.

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Officially Approved by Radio Association
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SMALL PARTS TO THE TRADE.

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Aluminium headbands, light and adjustable.
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60 Volts
3 Actual Amp-hour **37/6**



SOLD ON APPROVAL SYSTEM
Obtainable only from:
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or from Messrs. **CECIL POHLMAN, Ltd.**,
77, Great Portland Street, London, W.1.
Trade Supplied Telephone 1304

RADIOTORIAL QUESTIONS & ANSWERS.

(Continued from page 562.)

At the surface of the earth the air is a perfect insulator and wireless waves pass through it easily.

Sixty miles above the ground the atmosphere is probably completely ionised or electrified, this being partly due to the action of the sun's rays. This ionised "ceiling" is called the Heaviside Layer.

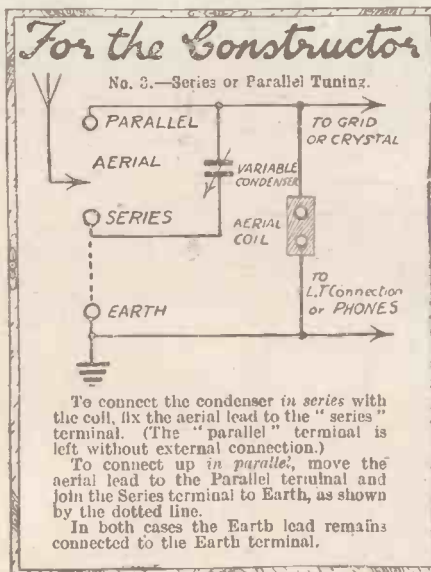
When a wireless wave falls upon a partially ionised layer it will be reflected, refracted, or bent, according to the angle of incidence. This will affect the signal strength at a distant receiving station, and variations in the layer will produce rapid variations in the received signals, even although the circuit adjustments at both transmitting and receiving stations are left unaltered.

There is, of course, no cure for such a condition, as its cause lies outside the earth.

ELIMINATING HUM.

S. T. R. (London).—I am troubled with an irritating hum in my loud speaker which persists in spite of having tried a counterpoise earth, removing the loud speaker to some distance from the set, and using antiphonic valve holders. What is the cause of the trouble, and how can I prevent it? I might state for your guidance that the aerial and earth leads are rather long, but this is unavoidable as my house does not allow of any other arrangement.

There is little doubt that the hum you experience is due to undesirable capacity effects and not to induction from power lines, etc. The trouble is probably directly due to the long aerial and earth



leads, which often prevent a set from oscillating, and cause a steady hum such as you complain of from the set.

Although you state the long leads for aerial and earth are unavoidable, we cannot see any reason why you cannot fit the set up near the aerial lead and use a loud speaker extension. In this way the hum would be minimised and tuning sharper in consequence. It would also assist you to tune in distant stations more easily, as with the absence of undesirable capacity effects, the set would oscillate more readily.

If this arrangement is not practicable, however, we suggest you carefully insulate the long aerial lead from the walls, and fix it on the ends of wooden or ebonite rods projecting from them. Needless to say, the above lead and the earth wire must be kept as far apart as space will allow, and under no circumstances must twisted flex be employed.

SELECTIVITY.

H. W. (Nottingham).—Is it possible to cut out the local station and get distant ones when situated about a quarter of a mile from the local stations aerial?

It is not possible with ordinary receivers, but has often been done with sets specially designed for selectivity.

The best of these is the super-heterodyne, but unfortunately at least six or seven valves are required.

Apart from the super-het, the best circuit is the "super-selective," which has attained considerable success in American cities, where there are often half-a-dozen stations working at once.

It was fully described in "P.W.," No. 144.

INCREASING SIGNAL STRENGTH.

J. E. R. (Hinckley).—I have a crystal set which is giving excellent results, but I want to know if there is anything I can add to give extra power? This is the best crystal set I have heard, and I do not want to be bothered with a valve or some kind of amplifier, as the crystal suits me perfectly, only I want it to be about twice as loud as at present. Can I improve it by a condenser?

We are afraid not. However excellent a crystal set may be, it is strictly limited as regards its output. No extra gadgets can make up for the fact that only the power received by the aerial is available to work the 'phones.

Although you appear prejudiced against a valve, we think you would find it a completely satisfactory solution of your difficulty.

SIZE OF ACCUMULATORS.

S. P. (Accrington).—I am getting a new set shortly. What size of accumulator shall I need?

A capacity of approximately 15-20 ampere-hours (actual) should be allowed for every valve of the bright emitter type having a consumption of 5 ampere each, and 20-30 ampere hours for valves taking 75 to 1 amp.

For valves having a consumption of 25 ampere or less a capacity of 5-10 ampere hours per valve will be suitable. The voltage of the accumulator will, of course, depend on the voltage rating of the valves.

COUNTERPOISE EARTH.

E. M. S. (Brighton).—What is a counterpoise earth, and why is it used?

Those who are troubled by induction noises due to the presence of nearby high-tension cables, dynamos at power-stations, electric railways or tramways (such as the system in Brighton), may find it better to use what is termed a "counterpoise," instead of an ordinary earth-wire. This consists of a wire or set of wires (usually not more than two) insulated and suspended between the aerial masts about six or seven feet from the ground.

The counterpoise usually runs parallel with the aerial, directly under same, about six feet from the ground. It is insulated like the aerial, and replaces the ordinary earth-wire connected to the set.

REPAIRS

By specialists skilled in every form of accurate and intricate coil winding.

Headphones, Loud Speakers & Transformers rewound, remagnetised, and reconditioned **EQUAL TO NEW** and returned the same day on C.O.D. system. The unsolicited opinion of one of our many satisfied clients — all I can say is, they are better than when new.

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VARLEY Proprietors: Oliver Pell Control Ltd.

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WIRELESS VALVES
THE ECONOMICAL COMBINATION

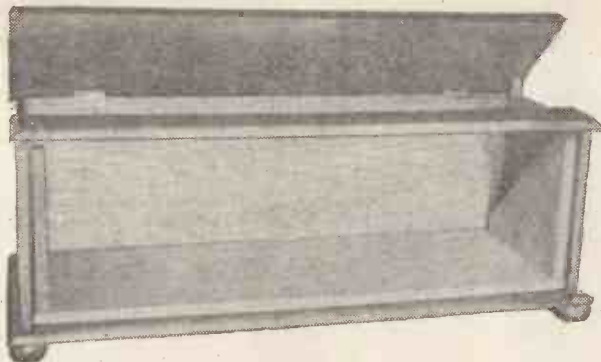
2v. '06 H.F. & L.F. each 9/-
2v. '34 P.V. 11/-

Obtainable from Lewis's Ltd.,
Liverpool and Manchester and
Lustrolox Ltd., West Brompton,
Nr. Macclesfield.

CAXTON 4-VALVE CABINET

Made for Sets, "As good as money can buy,"
"Harmony Four Receiver," "The Melody Three"

Special Cabinets made to Customer's measurements. Prices quoted.



Cash with Order. Fumed Oak ... £1 5 0

Dark or Jacobean Oak ... £1 10 0

Real Mahogany ... £1 14 0

Detachable 7" deep Base Board to mount 21" by 7" panel to slide out of Cabinet front.

Also supplied at 10/- extra with two beaded front doors placed 2 ins. in front of the enclosed panel.

Ebonite or Radion Panels Supplied and perfectly Fitted at low extra cost.

All Polished with the new enamel that gives a glass hard surface that cannot be soiled or scratched. **SENT FREE.**—Catalogue of standard Wireless Cabinets in various sizes and woods.

Packed and delivered free in U.K.

No. C3

CAXTON WOOD TURNERY CO., Market Harborough

Soldering simplified

The Fluxite Soldering Set will solve your soldering problems for ever.

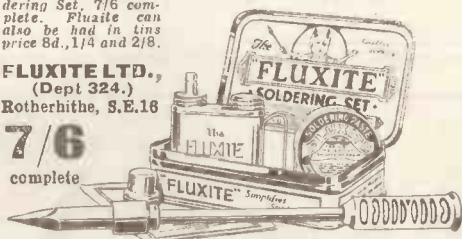
Everything from an aerial connection to a big multi-valve set may be soldered quickly and successfully with this simple soldering set.

The Fluxite Soldering Set is exceptionally suited for Wireless; it is simple and compact, and will last for ever. It contains a special "small-space" soldering iron with non-heating metal handle, a really efficient pocket blow-lamp, Fluxite, solder and full instructions.

All Hardware and Ironmongery Stores sell the Fluxite Soldering Set, 7/6 complete. Fluxite can also be had in tins price 8d., 1/4 and 2/8.

FLUXITE LTD.,
(Dept 324.)
Rotherhithe, S.E.16

7/6
complete



FLUXITE

*"Just listen to the difference
this LEWCOS COIL makes!"*



CLEAR as a bell the typical French Orchestra came through as the listener tuned in with his LEWCOS Coil. Coil after coil had been tried and discarded in an endeavour to realise that rare selectivity and fine tuning so essential to complete radio enjoyment.

Test this new coil yourself. Each LEWCOS Coil is tested in our laboratory. It is then boxed and sealed up, and reaches you in perfect condition. Be sure the LEW seal is unbroken. Ask your radio dealer for a demonstration.

No.	25	35	40	50	60	75	100	150	200	250	300
Price	4/6	4/6	4/6	5/-	5/6	5/6	6/9	7/6	8/6	9/-	10/-

LEWCOS Inductance Coil

3 LEWCOS advantages.

1. High electrical efficiency with great mechanical strength.
2. Great selectivity resulting in extremely sharp tuning.
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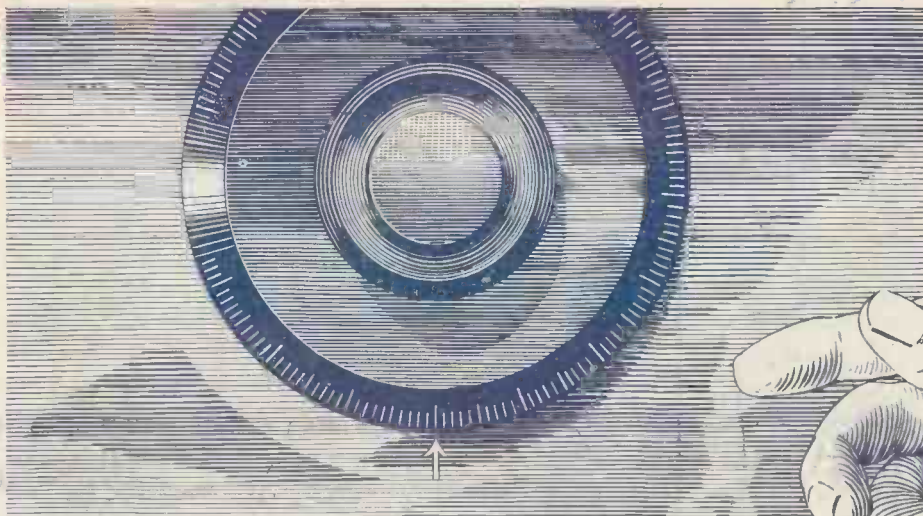
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CO. AND SMITHS LTD.**

Manufacturers of Glazite.

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J.U.D.





CHOOSE!



Take your choice of station from the multitude of calls that whisper in your 'phones. Then, just a turn to the dial of the R.I. Retroactive Tuner, **and you have it**, picked out easily and cleanly in a few seconds. No coils to plug in, just one instrument to cover the whole range of wave-lengths from 175-4,000 metres.

The coil is wound with a single layer of wire, a method which has been proved by eminent technicians to be more efficient than multi-layer winding.

In addition the **R.I. Retroactive Tuner** possesses the following advantages:

- (1) High frequency losses are reduced to a minimum, by means of the special dead-end switch, which short-circuits the adjacent turns and provides a magnetic screen.
- (2) Efficient aerial reaction is provided over the entire range of wave-lengths covered by the inductance, a very important factor when it is recognised how difficult it is to obtain the best reaction value over a wide number of wave-lengths.
- (3) Lastly, the **R.I. Retroactive Tuner** costs less than a set of plug-in coils with coil holder to cover a similar range.

Concise explanatory diagrams of circuits supplied with each instrument.

PRICE, 39/6

Write for the R.I. Blue and Gold Catalogue free on application.



THE MARK OF BETTER RADIO

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P.C. 33

THE "P.W." SUBURBAN THREE.

Popular Wireless

Every Thursday
PRICE
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No. 211. Vol. IX.

and Wireless Review
Scientific Adviser: SIR OLIVER LODGE, F.R.S., D.Sc.

June 19th, 1926.

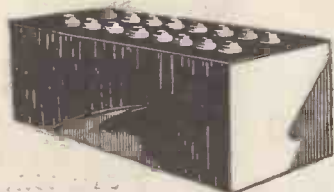


Special Features in this Issue.

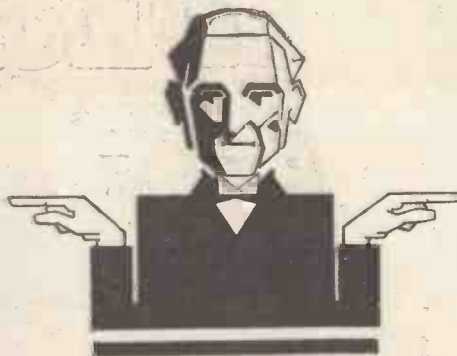
Switching-in Valve Circuits.
Berlin's New Studio.

The Care of L.T. and H.T. Batteries.
High Lights and Shadows.

Our cover photograph shows an American estate agent proving to a prospective client that his building sites are not situated in radio "blind spots."



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WHAT IS THAT ?

**Buy the one -
and win the other !**

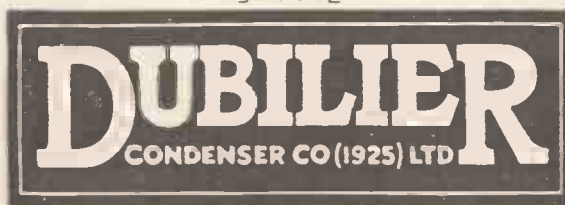
The Dubilicon is a multiple condenser containing eight separate units, the terminals of each unit being brought out to sockets on the lid. By using Clix plugs (made by Messrs. Autoveyors, Ltd., 84, Victoria Street, S.W.1) of which two are given with every Dubilicon, the units can be connected in a variety of series, parallel, and combined series-parallel arrangements giving a very large number of different capacities ranging from zero up to 0.011 μ F.

The Dubilicon, therefore, is of incalculable value to the experimenter who wants to find the best value of fixed capacity for any part of his circuit.

Every purchaser of a Dubilicon is entitled to enter for the £200 competition. All you have to do is to buy your Dubilicon from a Wireless dealer, and find out the total number of different capacities you can get by using the first five units. Full instructions are given with every Dubilicon sold.

Get one to-day !

**THE PRICE OF A DUBILICON IS 30/-—
AND THE PRIZE IS £200 !**



ADVERT. OF THE DUBILIER CONDENSER CO. (1925) LTD., DUCON WORKS,
VICTORIA RD., NORTH ACTON, W.3. TELEPHONE: CHISWICK 2241-23.

The NEW "BEST WAY" Guide for Wireless Constructors



Details of the three splendid sets described in this "Best Way" Wireless Guide are given below. The book is amply illustrated with photographs and diagrams, and constructors will find the wiring directions most lucid and straightforward.

The All-Station Loudspeaker Portable

A remarkably compact six-valve SUPER-HET. Aerial batteries and loudspeaker all completely enclosed and permanently connected. This receiver will appeal strongly to motorists, Caravanners, River Parties and seaside Bungalow inhabitants.

Three-Valve Portable

Several stations on the loudspeaker and many on Telephone receivers can be obtained with this receiver. It employs a frame aerial which is built into the lid of its neat carrying case. It will prove popular among Motor Cyclists and other Road and River Tourists.

Baby Portable

A two-valve receiver contained in a very small attaché case. Batteries and telephone receivers are enclosed and a reel of wire and earth pin for erecting temporary aërials are provided. This is the set for the Cyclist Holiday Tourer.

"BEST WAY"
PORTABLE SETS

Now on Sale

6d.

Air Spaced for sharp tuning

ASK your dealer to show you one of these new Eureka Low Loss Coils. You won't need to hold it up to the light to realise how each turn of the wire is well spaced from its neighbour. You'll see the advantages of its unique method of winding at a glance. Right from the time you began to be interested in Wireless you'll remember always reading how coils should possess a low self-capacity. Here is the coil with the lowest self-capacity on the market—a glance at the illustration will show you how well-spaced are its turns. Low self-capacity means sharp tuning and greater selectivity—you need it to-day with so many stations crowding the ether.

Great Mechanical Strength

But don't think that because the new Eureka looks a perfect network of spaced wiring that it is weak. Actually it is probably the strongest coil ever made, because it is wound on a solid ebonite former. Further it is reinforced just at the base where the most strain comes. It can be removed from its socket and roughly handled without the possibility of any harm being done. The Eureka method of mounting is another improvement. The ends of the coil are brought through the centre of the mount and soldered to the sockets. Electrical losses are reduced to a minimum. With its handsome green silk wire the Eureka Low Loss Coil will add distinctiveness to any set—you would certainly expect to pay more for such a beautifully made coil. And, finally, bear in mind the fine reputation enjoyed by all Eureka guaranteed Radio Products.

Reasonable Prices:

E20	40-150 metres	4/3	E100	285-1000 metres	6/3
E25	55-250 metres	4/3	E150	360-1500 metres	7/-
E35	80-375 metres	4/3	E200	470-1375 metres	8/-
E50	120-560 metres	4/6	E250	530-2725 metres	8/6
E75	185-760 metres	4/10			

All the above wave-lengths are obtained with a '0005 mfd. variable condenser in parallel.

EUREKA

Low Loss Coils

[Advt. of
Portable Utilities Co., Ltd.
(Eureka Radio Products),
Fisher St., London, W.C.11]

Only the new Cossor Point One can give you these three advantages

WHEN a man buys a Valve three questions flash through his mind. The first is "Will it be cheap to run? I cannot afford to use a valve that consumes a lot of current." Then follows "Is its filament strong? A valve that becomes useless after the first slight blow is expensive at any price." And finally "Can I be sure that it will give as good results after twelve months as on the first day I use it?"

These are the three essential needs of every wireless enthusiast. In this new low consumption Valve, Cossor is enabled to offer a Dull Emitter which utilises principles of construction so strikingly new that the whole future trend of valve design is likely to be influenced. Read below how this wonderful new valve, consuming only '1 of an ampere (hence its name) will satisfy your most exacting requirements.

1 Current consumption cut to one-third

Ever since the days of the bright emitter the whole resources of Science have been enlisted in ceaseless efforts to reduce current consumption. In the new Cossor Point One a further tremendous cut has been made. This new valve now requires only one-tenth of an ampere at a voltage of 1'8. That means that a Super-Heterodyne using seven of these new valves would still consume less current than a one-valve Set using one Bright Emitter. Or to make the

comparison still more striking the same accumulator which served the one-valve Set for, say, one week, would—with its cells connected in parallel to give two volts only—last longer than two months on a charge. Even then it would only need re-charging to prevent sulphation of its plates. This phenomenally low current consumption renders the Cossor Point One quite suitable for use with dry cells when required.

2 A shockproof filament suspension system

The system now evolved by Cossor offers outstanding advantages and automatically ensures for the valve a greatly increased life. Whereas in many valves the filament, being straight, is held under tension, that in the new Valve is arched and retained in position by a fine wire which is secured to a seonite insulator situated immediately above it.

It is not held under tension. The fine wire provides exactly the degree of elasticity required to enable the filament to withstand harmlessly the sharp concussion caused by an accidental blow. A knock which would shatter the filament in an ordinary valve is easily absorbed by this amazingly efficient shockproof suspension system.

3 Long life uniformity due to Co-axial Mounting

If a number of valves were made with identical filaments, grids and anodes without due regard to the exact spacing between these elements, all the valves would show very considerable variations in performance. Absolute uniformity in results can only be obtained among valves of the same class when the relative positions of their elements are identical.

In the new Cossor Point One the system of mounting infallibly aligns the filament, the grid and the anode at the top as well as at the bottom. Even the

hardest shock will fail to displace their exact relative positions.

Frequently the working characteristics of a valve will change as time goes on—perhaps due to filament sag or to the grid or anode being moved out of position through an accidental blow. This cannot possibly happen in a Cossor Point One. Users of Neutrodyne Receivers employing two or more stages of matched H.F. amplification will appreciate the immense importance of this exclusive Cossor feature.



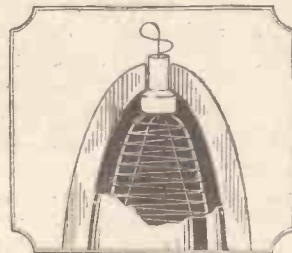
Cossor Point One

RED TOP:
For H.F. use consuming
'1 amp at 1'8 volts. 15/6

PLAIN TOP:
For Detector consuming
'1 amp at 1'8 volts. 15/6

Cossor Stentor Two

GREEN TOP:
For Power Valve consuming
'15 amp at 1'8 volts. 18/6



Observe how the seonite insulator securely aligns and holds in their correct relative positions, the filament, the grid and the anode. Through the centre of the insulator will be seen the fine wire which supports the filament and safeguards it against shocks.

Cossor Valves

Popular Wireless

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RADIO NOTES AND NEWS.

Next Month's Anniversaries—Fewer Lectures and More Music—Plenty of Programmes—
The Wireless Exhibition—New Radio Services For Britain—London's Breakdowns.

A Station for Wales ?

THE National Union of Welsh Societies has decided that there ought to be an All-Welsh broadcasting station, look you. At a recent meeting at Shrewsbury, Councillor Thomas was empowered to approach the B.B.C. on the matter, and I hear that if a separate station is not a practicable proposition the authorities will be asked to provide a larger proportion of all-Welsh items.

Next Month's Anniversaries.

A SPECIAL Dominion Day programme is being arranged for July 1st at several of the stations, including London and Daventry.

The exciting story of Canada's early settlers will be told in words and music, so for a time the ether will be full of tomahawks, Redskins, war-whoops, and other "scalp-raisers."

Three days later is "Independence Day," when the usual Sunday programme will be varied in honour of the great American holiday.

Cardiff on Carnival.

CARDIFF station is going to have a trip to the seaside one day in August, when the Radio Carnival will be held at Weston-super-Mare. By all accounts, it's going to be one big day! There will be a couple of parks full of carnival, about seventy side-shows, tip-top artistes, and one of the finest military bands in the country.

The whole of the Cardiff staff will transfer to Weston to give the programme. Is the Vicar of Mirth among the famous stars who have been approached? Yes, I think so!

Moscow Calling.

HAVE you heard Moscow? I have had several inquiries recently regarding some long-wave concerts sent out about 7 p.m. on Sundays, on a wave-length

nearly half-way between 5 X X and Hilversum. Scotch readers have reported them at fairly good strength, but farther south they are generally weak to moderate strength, and subject to fading.

From the particulars given, I think these programmes come from Moscow, on 1,450 metres. The central station, in that city, has been transmitting upon 12 kilowatts, but so far I have not succeeded in hearing a definite announcement of the station's name.

Fewer Lectures and More Music.

IT is too early yet to speak with certainty, but on the whole this year's summer-

Sussex Night.

THE re-shuffling of programmes due to the strike was very well arranged, but there are still a few items which the B.B.C. has not worked off. One of these postponements is "Sussex Night," that should have been relayed from Worthing via 5 X X and Bournemouth. According to present arrangements this broadcast will now take place on Thursday next, June 24th.

Plenty of Programmes.

EUROPE'S radio plans for the future show that listeners will have plenty of programmes to choose from when the dark days come again.

Norway is erecting a super-station like our own 5 X X, Germany will be putting programmes out on increased power from Königswusterhausen, the Dutch are gingering up the Hilversum station, and two or three other countries have high-power plans which have not yet been disclosed in detail. Add to all this the possibility of further developments in our own country, and the prospects for the future appear decidedly rosy.

First Lincoln Cathedral Broadcast.

ANOTHER of Britain's famous cathedrals will be on the air for the first

time on Sunday. Arrangements have now been made by the B.B.C. to broadcast the service from Lincoln Cathedral between 8.10 and 8.55 p.m., when the Venerable Archdeacon Blackie will give the address.

In Hot Water.

FOR using a 4-valve set, with an indoor aerial and no licence, Achille Alziari, of Bartholomew Road, Kentish Town, was summoned at the Marylebone Court recently.

(Continued on next page.)



An interested crowd on the Horse Guards Parade listening to a large experimental receiver broadcasting items from 2 L O.

time programmes promise to be well up to scratch.

A lot of elevating lectures have gone overboard, without anyone being a penny the worse for it, and instead of the talker that prevailed in the past, some lively music is being supplied.

As far as 2 L O and 5 X X are concerned the dance-bands are nicely varied. Eight different restaurants or halls are taking turns at the microphone with these outside broadcasts, and I hear that others are under consideration.

NOTES AND NEWS.

(Continued from previous page.)

Achille, who is a cook, was in a bit of a stew—but the magistrate, deciding it was not well done, ordered a fine of forty shillings, with twenty-one shillings costs, or twenty-one days' imprisonment!

Notre Dame Broadcast.

CARDINAL DUBOIS, the Archbishop of Paris, is conducting a campaign to keep radio programmes clean.

In support of the scheme he has granted permission for the installation of radio apparatus in the world-famous Notre Dame Cathedral, for the broadcasting of sermons.

Wireless Motor Picnic.

GOLDER'S GREEN and Hendon Radio Society has no intention of letting members lose touch during the fine weather. An attractive summer programme has been arranged, including a motor picnic, to be held on Sunday, June 27th, at Berkhamsted Common.

Those who like grasshoppers in their tea, and all others who are interested, should apply to the Hon. Sec. for particulars. (The address is Lt.-Col. H. A. Scarlett, 357A, Finchley Road, N.W. 3.)

The Wireless Exhibition.

I HEAR that the Royal Air Force Band has been secured for the Olympia Radio Exhibition, in September.

This show, which will probably be the biggest wireless exhibition ever held in this country, will run from September 4th to September 18th, at the New Hall, Olympia, Kensington.

The B.B.C. is co-operating, and the show will be open to all bona-fide manufacturers and distributors of British wireless goods.

New Radio Services for Britain.

PRESIDING recently at a general meeting of Marconi's Wireless Telegraph Co., Senatore Marconi made some interesting statements regarding long-distance wireless communication from this country.

He disclosed the fact that many new radio services were under contemplation, including some important South American "lines." It appears that the Marconi Co. is now licensed to conduct wireless telegraph services with every country outside Europe, as well as with Austria, Bulgaria, Denmark, Finland, France, Greece, Portugal, Russia, Yugo-Slavia, Spain, Sweden, Switzerland and Turkey.

What an ether we shall have, when they all get going!

Famous Microphone Preacher Dead.

THE famous American radio preacher, Mrs. Aimee McPherson—known all over the States for her wonderful wireless sermons—has been drowned while bathing. Only a few months ago she was in London, but news of her disappearance reached the Surrey Tabernacle recently, in a cable to the pastor.

Mrs. McPherson had controlled over fifty churches by wireless, and after she went in for broadcasting she was believed to have made 100,000 converts. The sensational suggestion has been made that

since she had roundly denounced the underworld, she has fallen a victim to reprisals by criminals.

Developing Photographs.

THE success of Captain Ranger's wireless-photograph apparatus, by means of which pictures are radioed across the Atlantic, has excited a good deal of feminine interest. The latest fashions can be sent across in a few minutes, and there has been a distinct success with portraits.

One lady has written to ask me: "Are the wireless photographs as good as the Kodak kind?" I am afraid that, photographically speaking, the answer is in the negative.

Canadian Changes.

CANADA recently had a thorough radio spring-clean, as a result of which it is hoped to improve the general standard of the programmes over there. All the broadcasting stations are now amalgamated (under the name of the Canadian Association of Broadcasters), and in future the

SHORT WAVES.

"The Boy (tuning radio): 'I wonder who's at the mike?'"

"Grandmother: 'Don't say "Mike," dear; it's "Michael."'" "Life."

"Broadcasting is the most miserably depressing job I know, and a studio gives me cold shivers."—Billy Merson.

"I like broadcasting, and I think it has an excellent effect on theatre business."—Miss Gwen Farrar (in the "Evening News").

"Listeners Inn: The public house with a loud speaker."—"The Star."

entertainments will be co-ordinated better than formerly.

By the way, C N R O, the Ottawa station, will be off the air on June 19th, 26th and 30th, to enable improvements to be effected in the transmitting equipment.

Beating the Cables.

HAVING become heartily fed-up with the cable communication to the Belgian Congo, one of the wealthiest and most influential business men of Brussels has been experimenting with a radio service.

A short-wave station was erected at Machelen, and so successful was the service that he made a sporting offer to all firms interested. For a given period he offered to send duplicates of their wires to the Congo, free of charge.

The result was, that although the ordinary cables were on the wire many hours before the duplicates were on the air, the latter reached the Congo 12 or even 24 hours before the wire transmissions. Needless to add, a regular short-wave service is now under consideration.

A Priceless Programme.

NO other orchestra in history has ever been equipped with the quality of instruments which listeners heard from K D K A the other night. The whole programme was played upon the rare instruments of the £100,000 Rudolf Wurlitzer

collection, which is now being exhibited in the Carnegie Museum at Pittsburg.

The first violin was a £10,000 Guarnerius, made way back in 1737. Two other violins, both Stradivaris, were used, valued at £5,000 and £5,300 respectively. Then there were a couple of solid gold kettle-drums, and a tenor drum with solid gold rims (of goodness knows how many carat) inlaid with mother-of-pearl. The funny thing about it all was that listeners had to admit that the programme sounded very much as usual, after all!

Lonlon's Breakdowns.

THE "old" 2 L O station at Marconi House has rendered yeoman service recently during the outbreak of "technical difficulties" at the Oxford Street transmitter. John Henry's Rams-gate broadcast was spoiled by an insulation fault, and as small defects of this character are bound to occur from time to time, it has proved good policy on the part of the B.B.C. to keep a complete station ready as a stand-by for emergencies.

Incidentally the Government wireless services seem rather sporty when the change over has to be made. It must be very inconvenient for the R.A.F. people in Kingsway when the Strand station starts up, and listeners are grateful for this consideration.

Radio Roll of Honour.

THE Washington Bureau of Standards has discovered a good plan for rewarding radio stations that are specially successful in keeping their transmissions upon the exact allotted wavelength. An "Honours List" is published periodically, and listeners are advised that the stations named in it are reliable ones. Consequently their transmissions are used for calibrating sets and wave-metres, giving these stations a prestige which is greatly envied by their wobbly brethren who cannot fix their frequencies with accuracy.

Broadcasting for India.

CALCUTTA and Bombay will each have a powerful broadcasting station by the end of the year, unless some unforeseen difficulty arises in the meantime. Probably both stations will be modelled on the lines of 2 L O, with the same power and range as the Oxford Street transmitter, states a Bombay message.

It is understood that the stations will be erected and maintained by a group of prominent business men, under the name of the Indian Broadcasting Co., Ltd. At the time of writing the prospectus has not been issued, but there is every prospect of plenty of capital for the project.

Some Foreign Items.

A NEW short-wave station, operating on 18 metres, has just been opened at Rocky Point, N.Y., by the Radio Corporation of America.

The "Radiophonie du Midi" broadcasting station at Toulouse has been placed at the disposal of Marshal Joffre, to aid his campaign for stabilising the franc.

Control of wave-length by the quartz-crystal method is so successful in the U.S.A. that in Chicago alone half a dozen stations have adopted the method.

ARIEL.



High Lights and Shadows

ANOTHER INTERESTING ARTICLE.

By B. HONRI.
(B.B.C. Engineer.)

"EXPOSE for the shadows and let the high lights take care of themselves," says the experienced photographer. This is a very sound piece of advice which we may with advantage annex for radio use. It will then become,

low notes should all be heard with their natural "body," the characteristic tones of each instrument being reproduced in the harmonics.

When listening for very low notes there is a risk of mistaking the harmonics and "over-tones" for the fundamental note of the instrument. The piano is particularly rich in harmonics and it is quite possible to recognise low piano notes by these alone, without hearing the fundamentals. Perhaps the best test is to listen during a symphony orchestra transmission for the sound of the tympani drums, which should come through as a beautifully rounded rumble and most certainly not as a knock. All these low notes are transmitted and may be received on all receivers which are not of the "soot and whitewash" variety.

Choke Coupling.

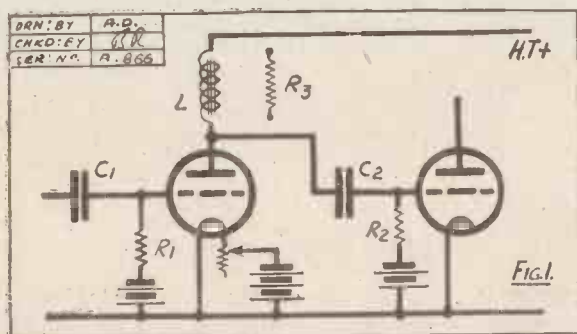
So far as our low-frequency amplifiers are concerned, it is simply a matter of passing on the various audible frequencies with the same magnification, taking great care that the low notes are reproduced. We have

With a resistance-coupled amplifier the greatest magnification per stage consistent with not too excessive H.T. is obtained when the impedance of the resistance is at least three times as great as the impedance of the valve. Furthermore, this impedance is constant for all frequencies providing the resistance is non-inductive. With a choke, however, the impedance varies with the frequency according to the inductance of the choke, and the lower the frequency the lower is the impedance of the choke. Remembering that we must "expose for the shadows," we must arrange that the choke shall have an impedance at, say, 50 cycles, about three times as great as the impedance of the valve. If we don't do this we shall lose magnification on those low notes.

Finding the Correct Impedance.

From the formula $Z = 2\pi fL$, when Z is impedance in ohms, f frequency, and L inductance in henries, the impedance of a 10-henry choke at 50 cycles (two octaves, below middle C) would be 3,140 ohms. So that a 10-henry choke would be very poor on the low notes unless a very low impedance valve was being used.

If the valve has an impedance of 30,000 ω then the choke should have an impedance of 70,000 ω , or 80,000 ω at 50 cycles, or an



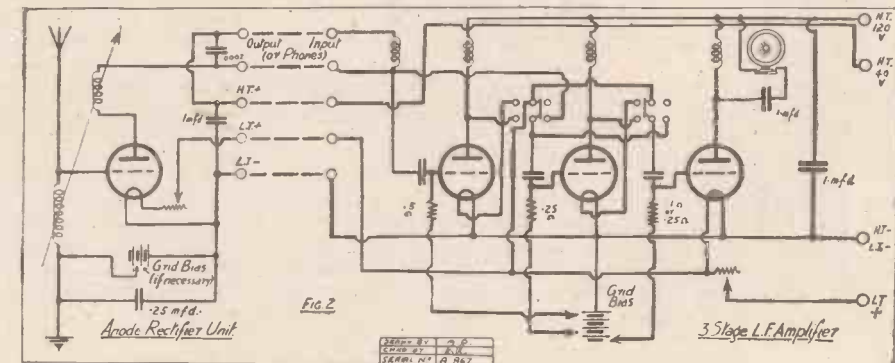
"Arrange your amplifier to reproduce the low notes and let the high notes take care of themselves." Broadly speaking, this advice is just as sound, so long as you don't take it so seriously as to use fifty-cycle-power transformers in your amplifiers!

If you expose your photographic plate to give good detail in the high lights, the shadows are black, giving an effect known as "soot and whitewash." If you make your exposure a little longer, you obtain detail in the shadows without spoiling the high lights. A good photograph has a nice graduation of tones from black to white and is not too contrasty. Now let us compare our prints with our loud speakers and we will find that in many cases the loud speakers are giving us "soot and whitewash."

Rich in Harmonics.

The loud speaker reproduces some high notes loudly, possibly favouring the band of frequencies around 1,000 cycles (two octaves above middle C), and there is a lack of "body" in the bass. (No, I am not extending the simile to embrace alcoholic beverages!)

Those of you who suspect your sets of giving soot and whitewash reproduction should notice whether you hear the pedal notes of the organ, the double bass, the low pianoforte, and the cello notes. These



discussed in previous articles how this may be done using resistance-capacity coupling, where the problem is fairly easy. We now come to choke coupling, perhaps the most difficult of all systems of L.F. coupling.

inductance of about 250 henries, and there are actually chokes on the market with an inductance of only 10-henries! Needless to say, a 10-henry choke with a 30,000 ω .

(Continued on next page.)

MAKESHIFTS.

FROM A CORRESPONDENT.

UNLESS one is fortunate enough to have at one's disposal a really well equipped workroom, there is bound to come a time when one lacks some little part that cannot be done without.

The following list of substitutes may be useful in an emergency, and may be suggestive of other makeshifts:

ANODE RESISTANCE.—Strip of paper thoroughly blackened with a soft black-lead pencil.

FIBRE STRIP.—Strong manilla envelope cut up and painted with shellac varnish.

FIXED CONDENSER.—Lead foil and waxed paper (e.g., the wrapping of a one-ounce packet of tobacco). Two pieces of each rolled tightly together will equal approximately .001 if the area of over-lap of the lead sheets is about three square inches.

GRID LEAK.—As for anode resistance;

PANEL TRANSFERS.—White water-colour paint, applied with a pen-nib.

SCREW-DRIVER.—A Meccano strip.

SISTOFLEX.—Insulating tape wrapped about the wire to be covered.

SOLDERING TAGS.—Scraps of thin "tin" cut from the inner lid of an airtight tin of cigarettes.

SWITCH.—Two valve-sockets together, with a valve-pin attached to a length of flex.

TWO-COIL HOLDER OR THREE-COIL HOLDER.—Coil mounts placed on table and moved in relation to each other. Even if the mounts will not stand upright when the coils have been inserted, they may be left lying down, one coil being moved over the other.

WANDER PLUG.—Wire held in position by match-stalk pressed into hole.

resistance of the choke, which should be as low as possible. If we use a choke of 100 henries with this valve we shall be able to go right down to 25 cycles, the region where one feels rather than hears notes. Whether the loud speaker will deal with such notes is, of course, another matter.

Grid Leaks and Condensers.

Then there is the question of the grid leak, R 2. This may be taken to function as a resistance shunted across the choke L, or in the case of a resistance amplifier across the resistance R 3, put in the plate of L. The value of R 2 should therefore be greater than R 3 in order to keep up the magnification per stage, and yet not so great as to make the amplifier "blast" or become unstable. More important still is the relation between L or R 3, R 2 and the condenser C 2. The impedance of the condenser $C \left(\frac{1}{2\pi f c} \right)$ should be low com-

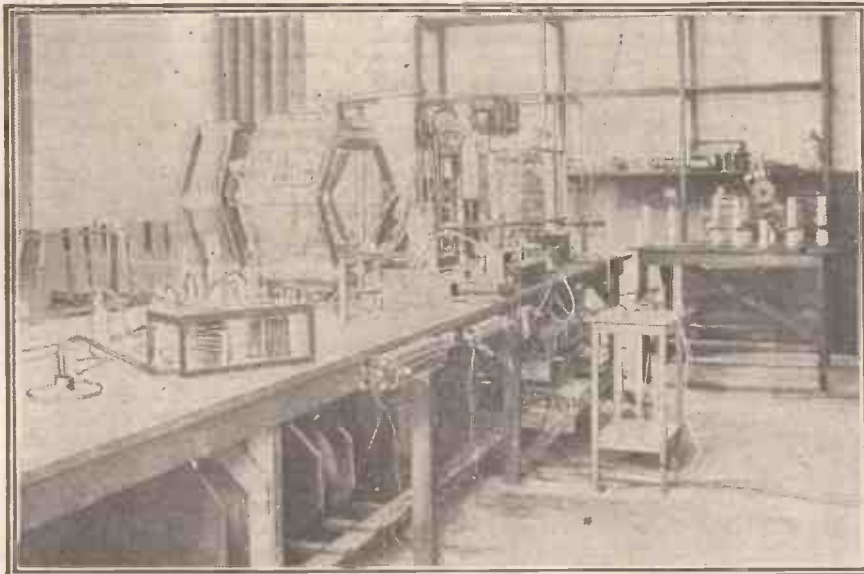
pared with the impedance of L, R 3, or R 2. So that the condenser C 2 should be as large as is necessary to deal with the lowest frequencies, but must be able to withstand fairly high voltages, at least twice the voltage of the high-tension supply. At the moment .015 mfd. are the largest capacity mica condensers obtainable at a reasonable price, but if really good .05 or .1 mfd. 500-volt tested paper condensers are used, results will probably be slightly better on the extreme low notes than with the lower capacity. It should be understood that the smaller this condenser is the less the bass will be passed.

A Suitable Circuit.

In Fig. 2 we have a complete 3-valve L.F. choke-coupled amplifier with switching for cutting down the number of valves. The higher the impedance of a valve, the higher will have to be the inductance of its anode choke. 60 henries is a good value for a choke used with a power valve, 150-200 henries for a 30,000 Ω valve, and 250 henries for 100,000 Ω valve. It is therefore obvious that if anode rectification is used, followed by choke coupling, with a valve having an impedance of about 30,000 Ω and a magnification of from 15 to 20, a 200-henry choke should be used in the first stage. Never use high impedance valves on a choke-coupled amplifier unless you are sure the chokes have a fairly high inductance. A far safer way is to lose a little magnification by using lower impedance valves if you are not sure of the inductance of your L.F. chokes. With a low impedance valve as an anode rectifier it is necessary to put a few volts negative bias on its grid in order to operate the valve on the lower bend of its characteristic curve.

Transformer or Choke?

A resistance-coupled amplifier is certainly much more easy to get "right" than choke coupling, especially as manufacturers of L.F. chokes give little information about their products beyond superlative adjectives. At the moment it is easier to obtain good transformers having high inductance primaries than it is to find good high inductance L.F. chokes. However, a little thought about these various details which effect the musical result may help to abolish "soot and whitewash" and give "tone" to the "exposure."



A section of the transmitting apparatus at the Hilversum (Holland) broadcasting station.

the strip of paper must, of course, be much narrower or longer, or both. Use a "hard" pencil for the grid leak. A broad line will serve.

INSULATING TAPE.—Paper wrapped about the article to be insulated, bound with cotton or string, and painted with shellac varnish. A coat of ordinary paint may be added if the joint is an out-of-doors one.

KNOB (4 B.A.).—Ebonite bush or cardboard disc clamped between two nuts.

LARGE COIL.—Two smaller coils connected in series and tightly coupled.

L.F. CHOKE.—A pair of 4,000 ohms 'phones.

L.T. BATTERY (for Dull Emitter Valves).—Leclanché cells. Those normally supplying current to the electric bell circuit will operate .06 valves quite well. Three cells in series should be used. Two cells will operate valves of the D.E.R. type for a time.

HIGH LIGHTS AND SHADOWS.

(Continued from previous page.)

valve will give worse distortion than a bad transformer. It is clear from this that unless high inductance chokes are used of the order of 200 henries or so, it will be necessary for every valve in our choke-coupled amplifier to have a low impedance.

Now let us take the case of a small power valve having an impedance of 8,000 Ω . The impedance of the choke at 50 cycles should be about 24,000 Ω in order not to lose the low notes. This time the choke does not need to have so many henries, and about sixty or seventy of the best will do the job well. This neglects the D.C.

The "Suburban" Three

The Set Designed, Constructed,
and Described by the "P.W."
Technical Staff.

TO obtain purity of reproduction, good loud-speaker volume, and fair range without employing a large number of valves is not an easy task, yet that is what is required by a great many listeners. It was with this end in view that the Suburban Three was designed, and this set really does act up to its title—it is a simple three-valver for suburban use.

It is capable of loud loud-speaker results, is easy to operate, gives pure reproduction, and has enough sensitivity to enable the



The complete receiver has a very neat and business-like appearance.

local station and 5 X X to be heard comfortably on the loud speaker up to at least 30 miles from the former and well over 100 from the latter.

A simple circuit is employed with its components so arranged that ease of operation is obtained without sacrificing the efficiency of the receiver in any way. An ordinary detector valve with reaction upon the aerial and the three-terminal system of series-parallel tuning is utilised, followed by two stages of L.F. amplification.

Two or Three Valves Available.

The first stage of amplification is transformer-coupled to the detector valve, and this is followed by a choke-coupled amplifier, the choke enabling the maximum volume to be obtained from the last valve without impairing the purity of reproduction. A double-pole, double-throw switch is provided for cutting out the second valve when only two valves are needed. This switch is so arranged that the grid of the last valve is connected either to the coupling condensers from the plate of the second or to the grid of the second valve.

This puts the last valve in the final position, whether two or three valves are being employed, thus enabling a last-stage power valve to be used with an adequate H.T. voltage on its plate.

The components required are given in the list on this page, and should be adhered to as far as possible, otherwise the panel drilling diagram and the baseboard lay-out

will have to be altered to suit the different components. It is advisable also to keep the transformer to a fairly high ratio with a valve of moderately high impedance in the second stage.

As will be noticed from the photographs, the American system of panel and baseboard have been adopted, enabling a very neat panel appearance to be obtained and maximum accessibility internally. It is advisable to purchase the panel and case together in order that they may fit properly. If they are obtained separately, the constructor may find it a tedious task to trim the panel in order to make it fit the case, especially if

this latter is not absolutely square.

The panel should be drilled according to the diagram given on page 573, after which the components should be mounted on it, and on the baseboard, and the latter placed in its case. The panel should now

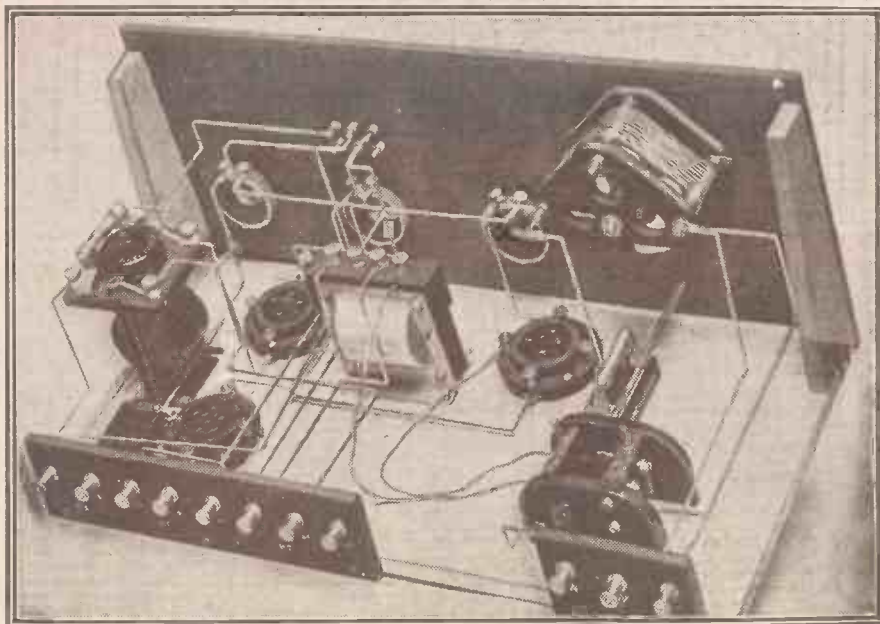
be placed in position against the baseboard, and the fixing holes drilled and the screws placed in position; this ensures that the

LIST OF COMPONENTS.

	£	s.	d.
1 Paragon Panel, 16 x 7 x 1/4 in., with cabinet and baseboard...	2	2	6
1 .0005 variable condenser (S.L.F.) (Peto-Scott)	12	6	
1 Lotus 2-way coil holder ..	8	0	
3 Lotus valve holders ..	7	6	
1 Nesthill D.P.D.T. switch ..	1	9	
3 Peto-Scott rheostats (30 ohm) ..	8	3	
1 "Ripault's" L.F. transformer ..	17	6	
1 A.J.S. choke unit ..	1	0	0
1 Atlas grid condenser and leak (.0003 & 2 meg.) ..	2	9	
1 .005 fixed condenser (Dubilier) ..	3	0	
2 Terminal strips (Peto-Scott) ..	3	6	
Wire, screws, transfers, etc. ..	2	0	

panel and baseboard are properly mounted, and the set will slide into its case without any difficulty.

(Continued on next page.)



An interior view of the set which should be useful to the constructor when laying out his apparatus.

THE "SUBURBAN" THREE.

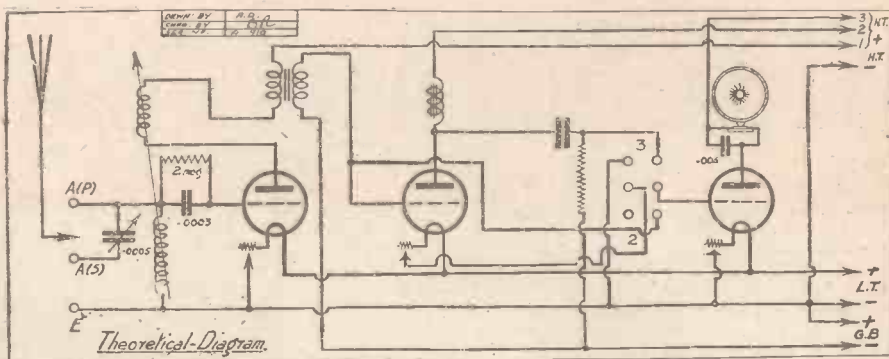
(Continued from previous page.)

When the components have been mounted the set should be wired up with 16-gauge copper wire, all the joints being soldered.

When the wiring has been completed, it should be carefully checked from the diagram, the point-to-point list of connections and the photographs, which latter should prove of great assistance when laying out the baseboard components and wiring-up the set. After this, the whole instrument should be thoroughly cleaned up, making sure that all traces of flux and loose beads of solder are removed. These latter should be very carefully searched for, as they have a nasty knack of getting between condenser vanes and underneath valve-holder tags, where they may later on cause no end of trouble.

Suitable Valves.

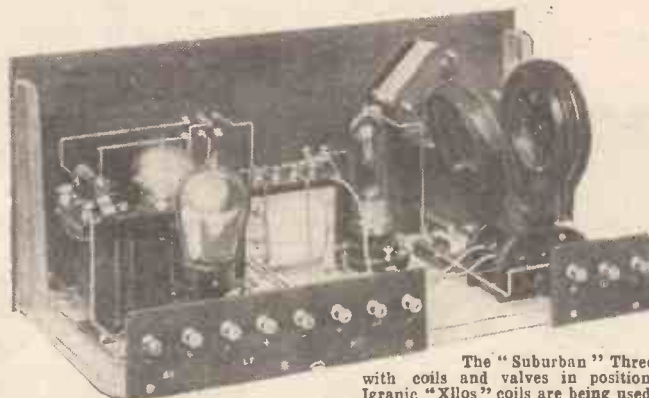
As regards accessories, these will depend upon the class of valve the listener prefers to employ. It may be stated here, however, that dull-emitter valves are preferable, and among these the 6-volters usually give best results on this receiver. Of this type such valves as the B.4, D.F.A.1, D.E.5, etc., all of these working extremely well in either position. If maximum results are to be obtained regardless of the type of valve or make used, we would advise a B.4 or D.E.5 in the first stage, with a D.E.5b, D.F.A.4, or a similar valve in the second, followed by another D.E.5, D.F.A.1, P.V.5 D.E. or B.4 in the last stage.



A similar group of impedances should be used if 2 volt or 4 volt valves are employed, and as separate H.T. plugs are provided for each valve and grid bias is included for the last two, each valve may be

made to work under its most efficient conditions.

Any good make of plug-in coil may be used, or home-made basket coils can be employed if desired. For the lower broad-



The "Suburban" Three with coils and valves in position. Igranig "Xilos" coils are being used.

casting band either series or parallel tuning may be used with coils of 25, 35, 50 or 75 in the aerial and 50 or 75 for reaction. For 5 X X parallel tuning should be used with an 150 turn coil in the aerial and 100 for reaction. For the benefit of those who are not familiar with the three terminal system of series parallel tuning, it will be noticed that there are two aerial terminals and one earth provided at the back of the set.

For series tuning, the aerial lead-in is connected to the centre terminal and the earth lead to that marked E. For parallel tuning, the aerial is connected to the left-hand terminal and the centre terminal and earth are joined together by a piece of wire and are connected to earth lead.

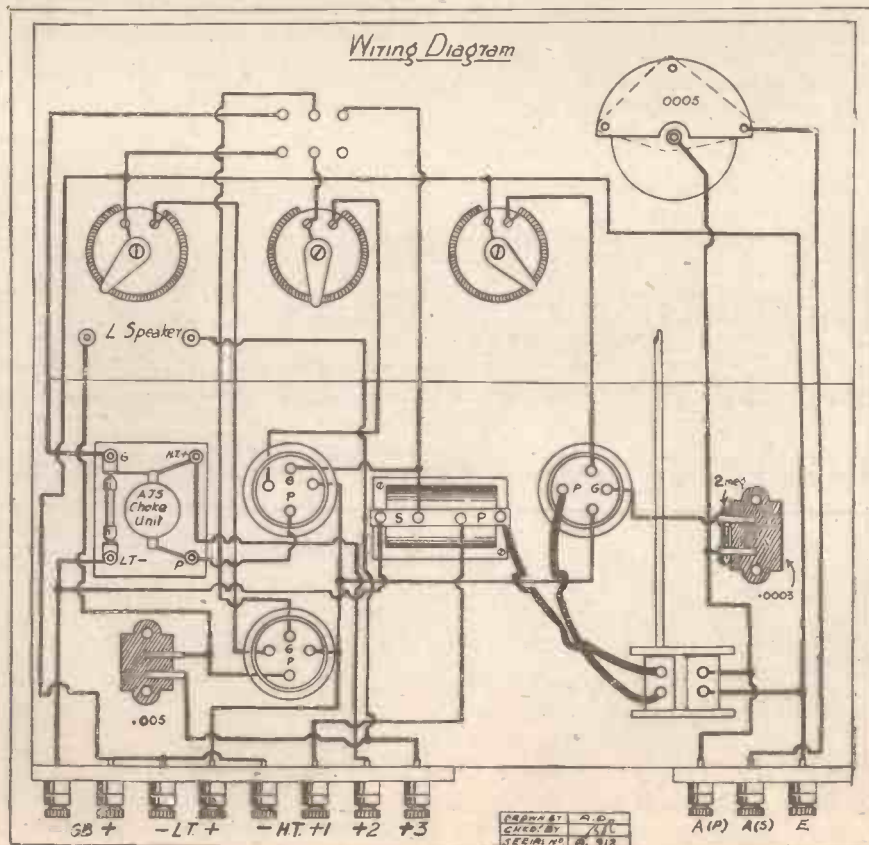
Operating the Set.

When operating this receiver it should be noted that either two or three valves can be used, according as the D.P.D.T. switch is in the left or right hand position. In the former the middle valve is cut out and the transformer output is taken directly to the grid of the third valve, the filament of the second valve automatically being switched off.

An H.T. battery having a maximum of at least 108 volts should be available, the last valve being given the full H.T. voltage. The detector-valve should work best at an anode voltage at approximately 40 or 50 volts, while the second valve should have a pressure between that and the maximum. A 9 volts grid bias battery, tapped every 1½ volts, should be used with the red plug in the positive end and the black one should be varied 3 volts negative and the full negative. Probably the last valve will take the full 9 volts.

It is just possible that slight clipping of some of the higher frequencies may occur when the set is working "all out," and this can usually be remedied by inserting a

(Continued on next page.)



THE "SUBURBAN" THREE.

(Continued from previous page.)

smaller grid leak on the choke unit, together with suitable variations of high tension and grid bias voltages.

In operation the set should be capable of picking up a large number of stations on

POINT-TO-POINT CONNECTIONS.

Aerial parallel terminal (A1) to moving plates of .0005 variable condenser, plug of fixed coil holder and to one side of grid leak and condenser, other side of which goes to the grid socket of 1st valve holder.

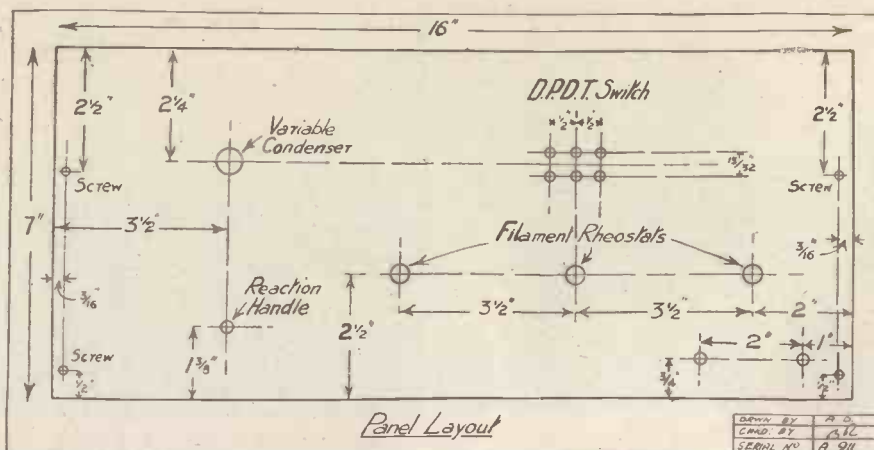
Aerial series terminal (A2) to fixed plates of variable condenser, earth terminal to socket of fixed coil and to L.T. negative, which is joined to H.T. negative, grid bias positive, one side of the 1st and 3rd rheostats, and to the bottom left-hand contact of the D.P.D.T. switch; the bottom centre contact of the switch goes to one side of the 2nd rheostat. The other side of each rheostat goes to one filament socket of the corresponding valve holder; the remaining filament sockets are joined together and to L.T. positive.

Plate socket of 1st valve holder to socket of moving coil holder, plug of which goes to the P.1 terminal of the L.F. transformer. The other primary terminal (P.2) is taken to H.T. positive 1 terminal.

S.1 terminal of transformer goes to the grid socket of the 2nd valve holder, and to the top right-hand contact of switch, S.2 to grid bias negative. Plate socket of 2nd valve holder to "P" terminal of A.J.S. choke, "H.T.+" terminal of choke to H.T. positive 2 terminal, "G" terminal of unit to top left-hand contact of switch, "L.T.+" terminal on to grid bias negative.

Top centre contact of switch to grid socket of 3rd valve holder.

Plate socket of 3rd valve holder to one loud speaker terminal, other loud speaker terminal to H.T. positive 3 terminal. A .005 fixed condenser is connected across the loud-speaker terminals.



the headphones on either two or three valves, while with careful handling and under good conditions it is not too much to expect several B.B.C. stations, besides the local, on the loud speaker when the three valves are in use.

The receiver is exceedingly easy to operate, there being only two controls, the aerial tuning condenser and reaction, though care must be taken when using the latter that the set does not oscillate violently and cause interference to neighbouring listeners. The filament controls can be turned on until the valves are at their correct brilliancy, and then left set until the receiver is switched off.

The Aerial and Earth.

A word about aerials. It is, of course, essential if maximum results are to be obtained that the set be used on a good outdoor aerial with an efficient earth. This is not to say that it will not work if an indoor aerial or even a frame is employed, but in the latter case the range will be limited to a very few miles indeed.

As a matter of fact, if a frame aerial is to be tried—it is not recommended—a slight alteration in the circuit would be advisable in order to enable the aerial coil to be placed in series with the frame.

If this is not done, no reaction effects will be possible unless, of course, the frame and the aerial coil are kept in parallel, a very inefficient arrangement.

If an indoor aerial is tried, probably the best results will be obtained by using a flat type aerial with three or four strands of wire or, alternatively, one of the "sausage," or cage type, having four wires about four inches apart.

In either case, we advise the use of an earth in order not only to give slightly louder results but to stabilise the set.

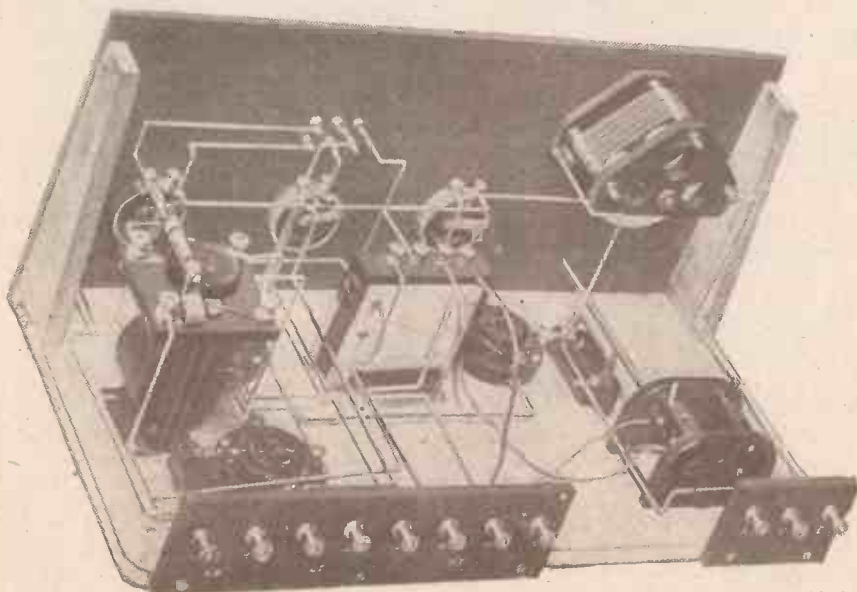
The earth should in every case be as efficient as possible, and if an outdoor buried earth is available, it is usually preferable to one composed of a water-pipe. A gas-pipe should never be used if it can be avoided, as such an "earth" very often wanders all over the house before reaching ground, and the use of red lead at the jointings is liable to make it very inefficient.

If a water-pipe is used, it should be one going direct to the main and the lead should be soldered on to it. In any case, the earth lead from the set to the earth should be as short as possible, and if a choice between a direct earth and a water-pipe is available, the shorter one should be taken.

Large Capacity H.T.

Among the accessories the listener should be careful about are the H.T. batteries and the loud speaker he uses with this set. If the valves mentioned on the previous page are to be used—and it is best to use those mentioned or similar types—a fairly large plate current will be required, and so a battery having an extra large capacity is necessary if it is to stand up to the work which will be required of it.

If an ordinary size H.T. battery is used, it will be found to run down rather quickly. This will, of course, mean not only unnecessary expense in the frequent replacing of the batteries, but also probable noisy reception as soon as the battery begins to run down. These noises may often be minimised by connecting a large fixed condenser of about 1 or 2 mfd. across the H.T. battery, but the only cure, or rather prevention, of such trouble is the use of an H.T. battery having an extra large capacity. Such batteries can be obtained from most of the big wireless dealers, or direct from any of the well-known battery firms.



Another photograph of the interior of the set with the valves and coils removed.



Conducted by our Staff Consultant, J. H. T. ROBERTS, D.Sc., F.Inst.P.

Metallic Sulphide Detectors.

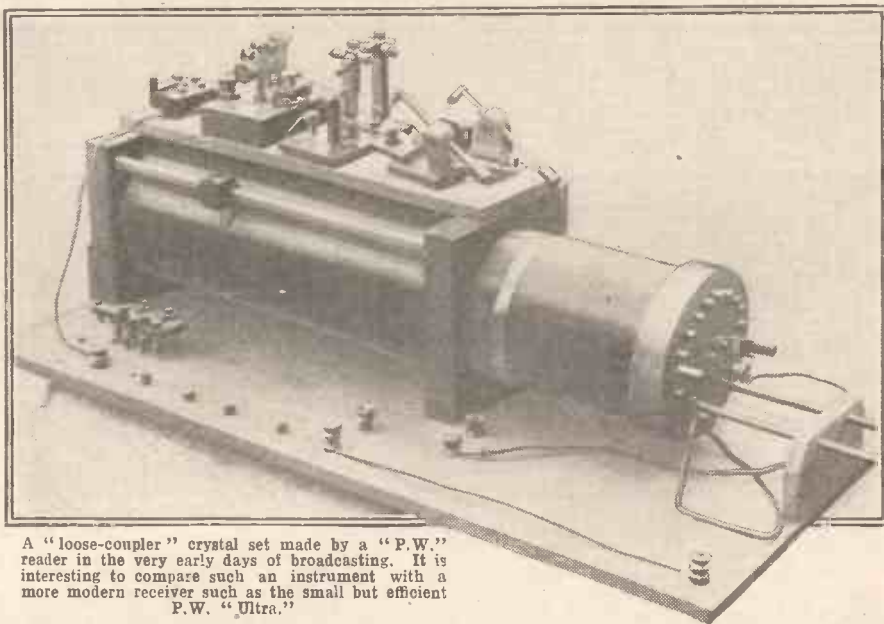
MOST crystal users have observed at some time or other that it is possible to get reception by merely making contact between the cat's-whisker and the crystal cup without any crystal being present. This is usually attributed to the presence on the surface of the metals making contact of a very thin film of some metallic compound which has a rectifying property similar to that of the crystal; in this connection it will be remembered that most wireless rectifying crystals, or, at any rate, those which function best, are usually metallic sulphides.

A well-known French scientist, Monsieur H. Pelaron, has carried out lately a number of experiments on those lines and has obtained some very interesting results. He finds that if a strip of metallic lead be exposed for a very short period, a few seconds, to the fumes from burning sulphur, it will develop a sufficient thickness of lead sulphide to make it quite an excellent detector. It is as good, in fact, as a first-class specimen of galena. Similar sensitive films are obtained by treating in the same way surfaces of nickel, iron, bismuth, copper, tin and zinc. In the same way a film of certain carbon compounds may replace the film of sulphur compound. Much further interesting information on this subject may be found in an article entitled "Detection in Wireless Telegraphy," by H. Pelaron, in "La Nature" (Paris), page 397, December 19th, 1925.

Interesting Carborundum Experiments.

Whilst on the subject of crystals, some interesting work has lately been carried out by a well-known English engineer, Mr. H. N. Dowsett, on the use of carborundum crystals as electrical "safety valves." It is well known that carborundum and certain other crystals will allow an appreciable current to pass when the applied voltage exceeds a certain critical value, but will allow hardly any current to pass when the applied voltage is below this value. This valve-like property of the carborundum crystal may be turned to advantage in making safety resistances to relieve surge voltages. The threshold voltage of a single carborundum point contact is quite small, about 2 volts. This may be increased, however, by placing a number of crystals in series, or, what is much simpler in practice, by compressing carborundum powder in a tube, suitable terminals being introduced at the two ends of the column. Mr. Dowsett has constructed a resistance

in this way, using carborundum powder passed through a sieve having 80 strands to the inch and a tube $2\frac{1}{2}$ inches long and 0.04 of a square inch in cross-sectional area, the powder being compressed by a total force equal to 10 pounds weight. The threshold voltage in this case was found to be just above 5,000 volts. Below that voltage practically no current passed, whilst just above the voltage mentioned



A "loose-coupler" crystal set made by a "P.W." reader in the very early days of broadcasting. It is interesting to compare such an instrument with a more modern receiver such as the small but efficient P.W. "Ultra."

the tube carried a current of 750 microamps.

Home-Made H.T. Accumulators.

With the increasing popularity of the high-tension accumulator, in place of the more conventional dry battery, there are certain special precautions to be observed which it may be useful to mention. Many amateurs now make up their own H.T. accumulators by means of a series of test-tubes or other suitable small containers. I have several times received communications from readers giving accounts of troubles experienced, and asking various questions as to how the same are to be overcome. One of the commonest troubles appears to be leakage between successive cells. It should be remembered that there is a considerable potential difference between

the cells at the end of a series—this may be as much as 20 or 30 volts. It has been argued that since there is a metallic connection, namely, a lead bar, between each cell and the adjacent cell, leakage cannot arise. This, however, is an incorrect view, for it must be remembered that the acid in any cell assumes a different potential from either of the lead plates, and the plate which is negative in one cell is positive in the next.

How to Prevent Leakage.

The mean potential difference between the acids in adjacent cells will be approximately 2 volts and if the tops of the containers and the woodwork, etc., are covered with acid or other contamination there will be an electrical leakage between the acids in the two cells, notwithstanding that there is a metallic connection between the cells. In other words, the nature of the metallic connection is such as to maintain a potential difference of about 2 volts between the acids in the two containers, whereas the nature of a leakage connection, of the kind mentioned above, is not such as to maintain this potential difference, and hence leakage occurs. Consequently, it is very important that the tops of the jars or other containers, for a distance of about $\frac{1}{2}$ inch to 1 inch down,

should be dipped in molten paraffin wax, which will prevent "creeping" of the acid. It is a good plan to impregnate any woodwork which is used in the frame or cabinet of the battery with paraffin wax.

L.F. Transformer Design.

Readers interested in the design of low-frequency inter-valve transformers can find a very interesting paper in the "Institution of Electrical Engineers," by Mr. P. W. Willans, M.A. In this paper, the factor of expression for the voltage-amplification of a valve followed by a transformer is developed in its simplest possible terms, and various particular cases are considered. The importance of low-leakage inductance for the uniform amplification of the higher frequencies is emphasised. A practical

(Continued on page 586.)

WHEN the owner of a crystal set desires to increase the volume of signals, either in the headphones or to work a loud speaker, he generally begins with a transformer coupled L.F. valve. And, provided he uses a suitable transformer, the results are often excellent. Later, influenced by the many articles appearing in the technical press extolling the greater faithfulness of reproduction obtainable with properly designed resistance or choke coupled stages, he often attempts to apply these methods to the first stage of his crystal/L.F. amplifier set, and sometimes with very disappointing results. The plain fact being that, strictly speaking, resistance capacity coupling cannot be used immediately after a

COUPLING A CRYSTAL DETECTOR TO AN L.F. VALVE.

INCREASING VOLUME.

By Lieut.-Commander H. W. SHOVE, D.S.O., R.N.

recently formed the subject of a patent granted to Mr. A. W. Sharman, and which is designed on a special principle, viz., the rectification of *voltages alone*, the condenser, which Mr. Sharman places between the aerial and the crystal detector instead of on the grid side, serving to prevent the flow of any current in the grid circuit.

This ability of the crystal to act as a "one way conductor" for voltages, as distinct from current, has been long neglected and little investigated, either theoretically or in practice, hitherto, the important advantages of this producing a crystal circuit wherein "potential" and not "power" is the governing factor seeming to have been generally lost sight of. In the Sharman circuit the condenser is made very small, thus reducing the damping and improving selectivity, while sufficing to pass voltage fluctuation to the detector.

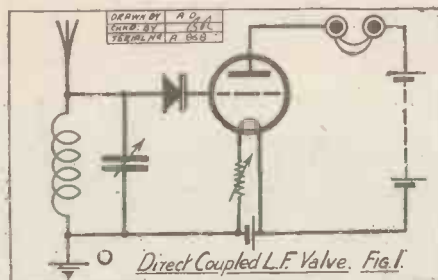
A great advantage of all these transformerless arrangements, but one which is almost invariably overlooked, is that H.F. impulses are still present in the anode circuit, instead of being suppressed in the transformer. And these can be used to obtain reaction, in exactly the same way as if the valve itself

were the rectifier. Fig. 3 shows the Sharman circuit, complete with reaction coil. It seems to be capable of giving quite as good range and signal strength as a straight one-valver, but the purity of tone will be superior, owing to the crystal rectification.

Suitable for Distant Stations.

The direct coupled method has long been recommended for the amplifications of very weak signals. But, as the grid filament impedance of

the valve is by no means infinite, it has not been considered of much value when they are strong, as from a local broadcasting station. For any appreciable current will not only cause inefficiency (the amplification of a direct coupled valve is often practically nil with strong signals), but sometimes actual distortion. In the Sharman (or capacity coupled) circuits this cannot happen. But in view of the fact that for reception of the local station we do not (or should not) require to use reaction and that the distortion due to a single stage of transformer

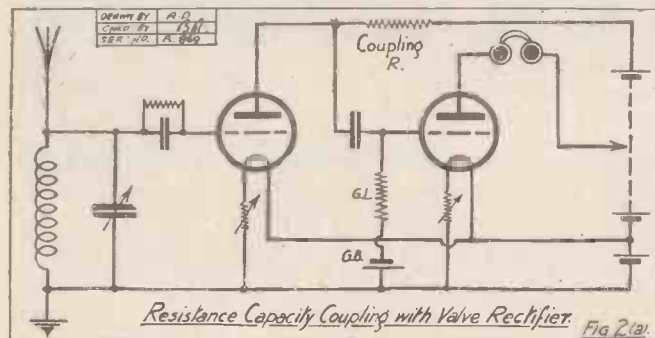


Direct Coupled L.F. Valve. Fig. 1.

crystal detector, since the principle involves the anode potential of a *preceding* valve. So that, with a crystal, there is no place for the coupling resistance.

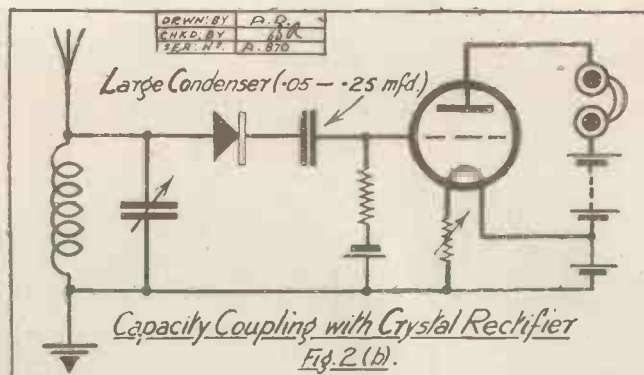
The "Sharman" Circuit.

The conventional way of coupling an L.F. valve to a crystal detector, without a



Resistance Capacity Coupling with Valve Rectifier. Fig. 2(a).

transformer, is the "direct" method, shown in Fig. 1. But many amateurs make up sets wherein the condenser shown in Fig. 2 (b) is included in the grid circuit, this arrangement being arrived at without a real appreciation of principles, by the simple process of eliminating the unnecessary anode resistance from the ordinary resistance capacity circuit shown in descriptions of valve sets (Fig. 2 (a)). The sets so made up generally work very well, for, in addition to admitting of the use of grid bias (impossible with direct coupling), the condenser has really brought the unwitting constructors to work their crystal sets on an important new principle. For Fig. 2 (b) approximates to a circuit which has



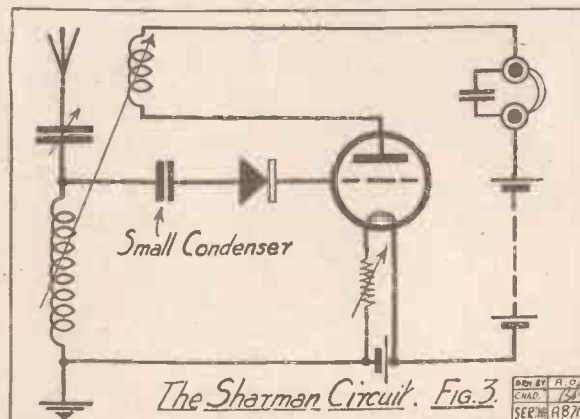
Capacity Coupling with Crystal Rectifier Fig. 2 (b).

coupling following the crystal is generally negligible, the writer's predilection is for the latter for local work, and for the Sharman for distant stations. But, if the signals are not "boosted up" by reaction the circuit of Fig. 1 (direct coupling), is often very satisfactory, even at quite respectable ranges.

A Further Advantage.

The Sharman circuit has a further advantage over those in which current flows, as has already been noted, viz., its selectivity. And it is worthy of remark that, in this, it seems to have the advantage over even a valve rectifier, owing to the very slender coupling of the condenser. The writer has used a 3-plate vernier condenser here with good results, the best setting being found by trial. This will be permanent for a given valve and crystal,

(Continued on next page.)



The Sharman Circuit. Fig. 3.

COUPLING A CRYSTAL TO AN L.F. VALVE.

(Continued from previous page.)

and independent of tuning adjustments. A series, A.T.C., is recommended, so as to obtain maximum voltage across the A.T.I.

Fig. 4 shows two suggested crystal/L.F. circuits for loud-speaker work: (a) for local reception, with transformer; and (b) with Sharman circuit, for longer ranges.

Transformer Ratios.

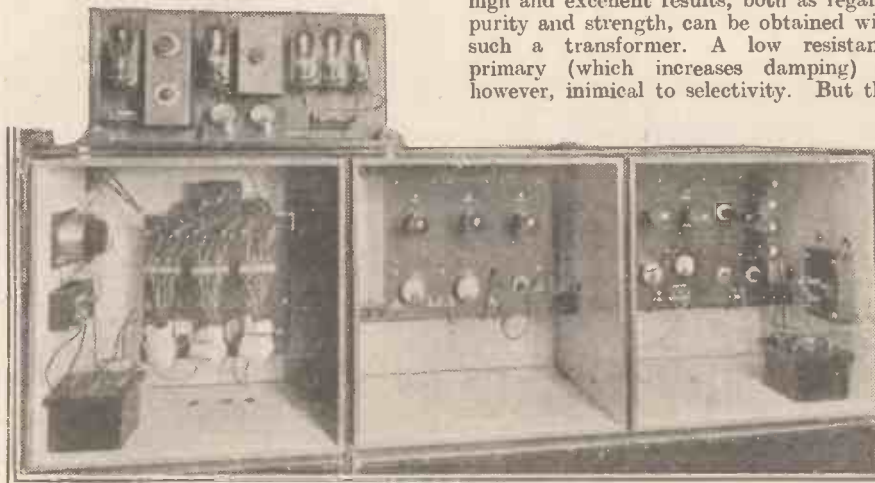
A word as to distortion in transformer coupled circuits. The transformer has acquired most of its bad reputation in this matter in sets using rectifying valves. And, in the writer's opinion, it has earned it. But, as has been very ably shown by F. M. Colebrook, the conditions with crystal

have a high impedance in both circuits. But with a crystal 8/1 is not generally too high and excellent results, both as regards purity and strength, can be obtained with such a transformer. A low resistance primary (which increases damping) is, however, inimical to selectivity. But this

To overcome this difficulty, the underside of the panel should be divided into, say, half-inch squares, marked with a sharp point. By this means the symmetrical positions of the parts may be easily chosen.

As it is very important to have a good earth connection, the following hint may be useful.

A strip of tinfoil is wound several times round the part of the pipe where the connection is to be made, and the earth clip placed over the tinfoil. The latter,



One of the large land line amplifiers in use at the new Rome station.

rectification are very different. The resistance of the crystal being low, as compared with the anode/filament impedance of the valve, a low resistance primary winding is indicated in this "power" circuit. On the other hand, as we wish for voltage, and not current, in the secondary this should be large. Thus we should use a high ratio transformer.

As a rule a ratio greater than 4/1 is undesirable with a valve rectifier, where we

is not generally a prime consideration for local reception.

SOME USEFUL HINTS.

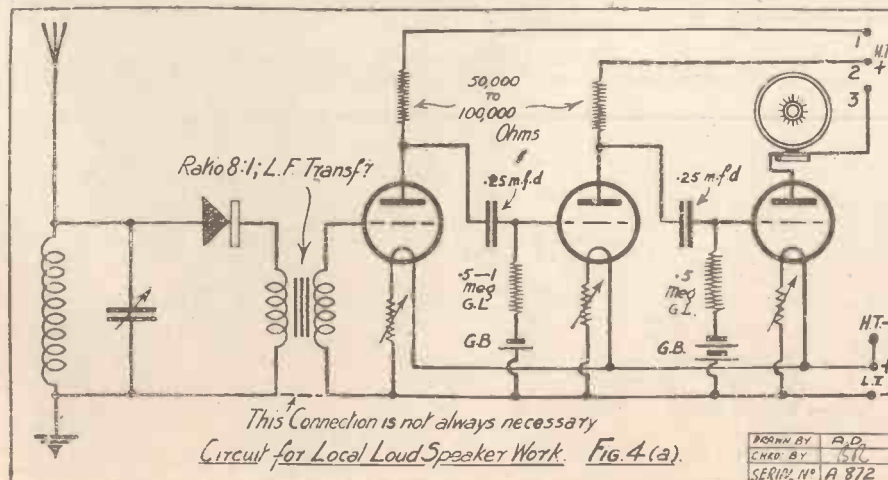
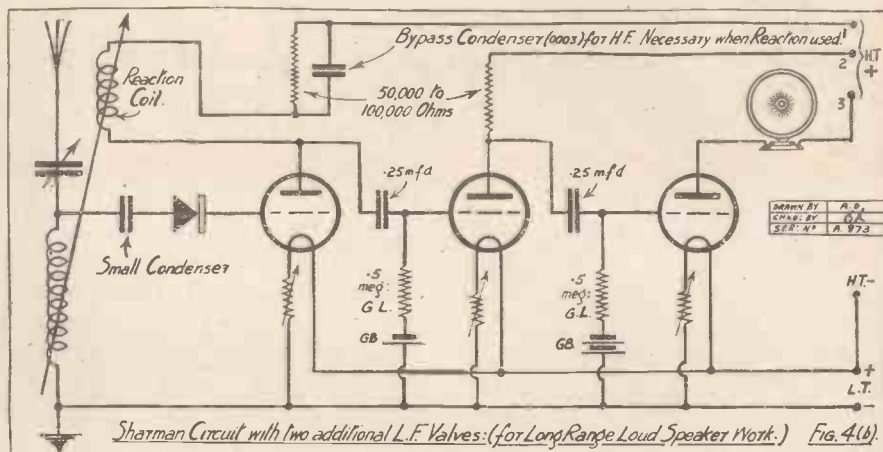
WHEN laying out a panel not according to a special design, it may not be found easy to space the components symmetrically.



The microphone installed in the Berlin Opera House.

being soft, takes up any irregularities in the surface of the pipe, making an excellent contact.

The appearance of home-made coils may often be improved by mounting them with celluloid strip, which also serves the purpose of protecting the insulating covering of the wire from wear and accidental damage. Several suitable types of strip are now on the market, and are very cheap. When it is desired to bind a coil with this strip, the difficulty of sticking two ends of the celluloid together may be overcome if liquid court-plaster (obtainable at small cost at any chemist's shop) is used as the adhesive.



Making a Loud Speaker



THE cone-shaped type of loud speaker which came in about twelve months ago has certainly proved itself a better reproducer of music and speech than the paper-pleated loud speaker which preceded it. Many readers who made the pleated loud speaker would like to know how to make the cone-shaped speaker, but before proceeding to give the constructional data it may be of interest to give a few words

* * * * *

**A Practical Article for
Constructors.**

By **R. S. RUDLAND.**

* * * * *

room, providing a suitable set is being operated. Another thing, with regard to the construction of the cone-shape type of speaker, it is much simpler to make than the pleated type.

The materials required are:

One piece of drawing paper, 15 in. square;
One piece of three-ply wood, 13 in. square;
One block of hardwood (ash or oak),
 $6 \times 4 \times 2$ in.;
One piece of wood, $14\frac{1}{2} \times 5 \times \frac{3}{4}$ in.;
One piece of ebonite, $2\frac{1}{2} \times 1 \times \frac{1}{2}$ in.;
Two telephone terminals; and
the usual "Brown" reed-type earpiece,
with rod.

To proceed with the construction, take the drawing paper and thereon draw the figure according to sketch (Fig. 1). Cut the figure out, leaving the overlap for pasting together, also the serrations.

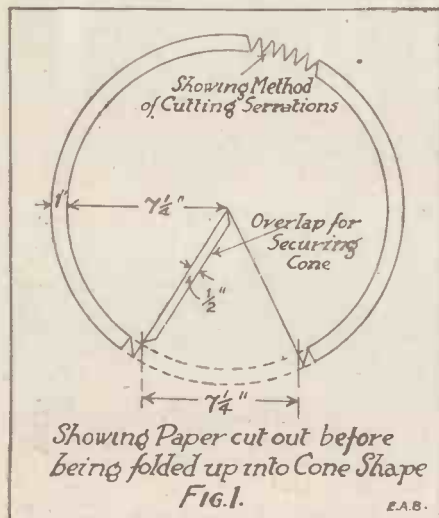
Mounting the Diaphragm.

Now draw up the paper to form the cone and paste the edge of overlap to the plain side of cone. Place a weight on a strip of wood or anything that will run the length of the join and let it thoroughly dry (Fig. 2). Whilst the cone is drying the other parts can be got on with. The three-ply wood may now be cut square, or round, according to fancy or the ease with which it can be cut. We will assume that a circular shape has been decided on.

Determine the centre of the piece and scribe a circle 13 in. diameter. Cut out the circle. With the same centre as before scribe a circle $3\frac{1}{4}$ in. radius. Around this circle mark off six centres equidistant apart. From each of the centres mark off a hole $2\frac{1}{2}$ in. diameter. From the centre of the piece of wood—i.e. the original centre, make a hole for a good push fit for the earcap of the Brown earpiece. The article should now look like Fig. 3. Nicely clean up with glass paper ready for mounting the paper cone. By now the cone will be dry sufficiently enough to proceed with the construction.

Mount the cone on the circular wooden frame by pasting the serrations down,

taking extreme care in keeping the apex of the cone in a dead centre line with the centre of the frame (Fig. 4). Place a few weights on the edges to hold them down till they set. While this is drying the support can be prepared. Clean up the block of hard wood, putting a chamfer round



regarding comparative tests. The cone shape is a better reproducer, generally, than the pleated type, and the best average diameter for the cone is in the neighbourhood of 10 in.

Pure Reproduction.

Although one cannot claim for it the "punch" that a good horn type of loud speaker has, it is certainly pure and sweet in tone, and in no way can it be said to be "gramophoney." This will no doubt be all that is required by those who wish for pleasant volume sufficient for an ordinary

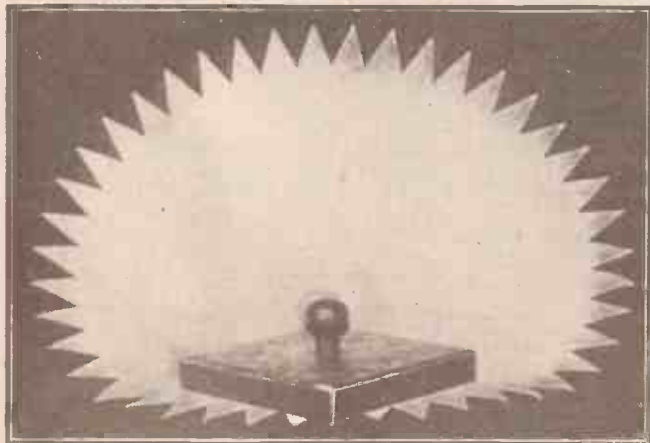


Fig. 2. The paper diaphragm after it has been cut and pasted together.

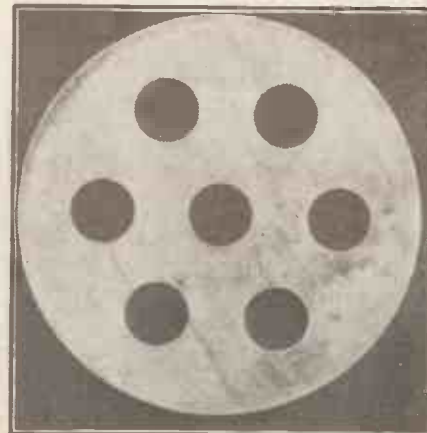


Fig. 3. The wooden support can be drilled as above to make it lighter and to allow sound to come through it.

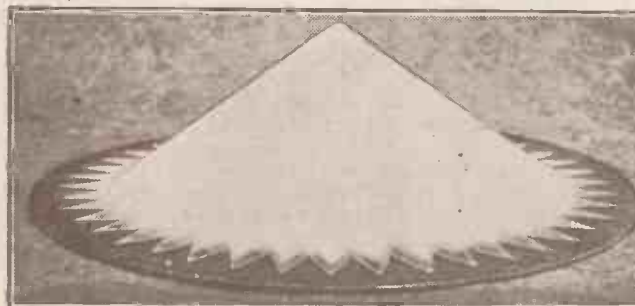


Fig. 4. The paper cone after it has been fixed in position on the frame.

the top edges. Take the length of wood $14\frac{1}{2} \times 5 \times \frac{3}{4}$ in., clean and square up and mark from one end $6\frac{1}{2}$ in. and from a centre $2\frac{1}{2}$ in. along mark off a hole $2\frac{1}{2}$ in. diameter (Fig. 5). The method of fixing the upright to the base can be whichever way is the easiest. The writer cut a slot in the base the same size as the upright and made a driving fit (Fig. 5).

Assembling the Loud Speaker.

All that remains to do now is to assemble the parts together. Erect the upright on the base and screw the frame, holding the paper cone, to the upright, fixing the frame flush with the top, and the hole for the earpiece central with the clearance hole in the upright. The next thing to claim our attention is the stylus of the earpiece.

Not many amateurs are in the position to run a 10 B.A. thread down a rod, but any electrical engineer would supply two 10 B.A. nuts and washers and a rod 5 in. long, screwed 10 B.A. one end for about

(Continued on next page.)

MAKING A LOUD SPEAKER.

(Continued from previous page.)

1½ in. and 12 B.A. the other end for about ¼ in. to ½ in. The cost would not be much more than one shilling. Screw the 12 B.A. end into the reed of the earpiece. On the other end screw a nut down about 1 in. and (Fig. 6). the apex of needle, push the end through the apex of the cone. Note how far the nut is in position. Having screw the other nut and the other side, or out-cone and the job is finished.

Make sure far enough, be damaged through it. is from the piece and just presses the earpiece done this, washer on side, of the



Fig. 6. The earpiece with the long stylus in position.

permanent connections from the earpiece to the terminals at the base. The completed article will now have the appearance of Fig. 7, and the whole outlay, excluding the earpiece, should not be more than two or three shillings.

The earpiece itself can often be picked up very cheaply from some surplus store, or may be obtained from the makers direct. The usual aluminium diaphragm is, of course, not required.

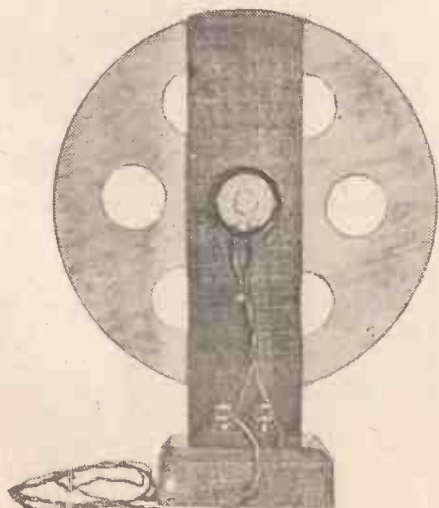
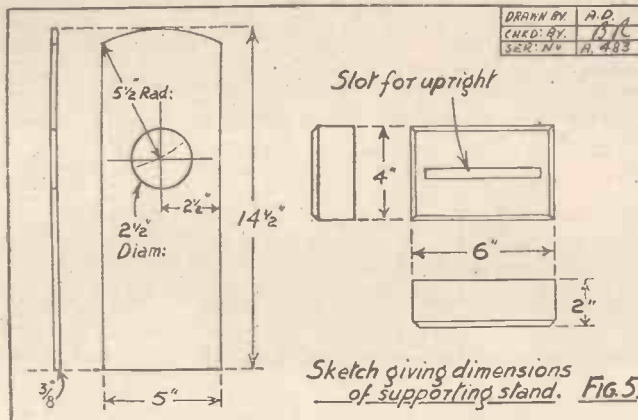


Fig. 7. A rear view of the completed loud speaker.

IRON OR COPPER PYRITES?

By J. F. C.

MANY people have a real difficulty in distinguishing these rectifying minerals from each other. Both are yellow minerals, they are both similarly radio-sensitive, very often they both take upon themselves an almost identical crystalline form, and they are often found together in the same locality.



THE NEW REISZ-TELEPHONE AND LOUD SPEAKER.

By DR. ALBERT NEUBERGER.

EUGEN REISZ, the inventor of the marble block microphone, has now adapted the elements of his microphone to the construction of headphones and loud speakers. He has, furthermore, obtained the same surprising success as with his famous microphone.

In the Reisz-microphone the oscillating parts are replaced by a crystalline powder of extreme fineness so that it is enabled to work without any sign of self-oscillation. Now also in the telephones and the loud speaker, Reisz has replaced the diaphragm by a crystalline powder, and in these two cases all the natural periods that cause distortion are eliminated.

A New Method.

The new telephone has neither an electromagnet nor a diaphragm of metal or mica. The excitation is carried out by electrostatic influence. The crystalline powder of the new telephone and loud speaker is exposed to electric forces, and its single parts commence to move about under the influence of these forces like the small balls of pith begin to dance under the influence of a sealing-wax rod that is electrically charged by friction.

The Reisz-'phone weighs only 3½ oz. The loud speaker has no horn, but is in the

The general rule for distinguishing these minerals at sight is to remember that iron pyrites has a *brass yellow* appearance and a smooth and sometimes almost polished surface. On the other hand, copper pyrites, which is generally more valuable than the former ore, has a more *golden yellow* appearance, and it is very seldom found in a highly smooth condition.

A Conclusive Test.

The most conclusive test, however, is to immerse a small fragment of the mineral in a few drops of nitric acid, when the copper pyrites will almost immediately turn the liquid a bluish green colour.

These facts are worth while remembering, for these minerals, although they are not commonly to be seen in radio dealers' shops, are often to be picked up in various parts of the countryside, and in this manner quite a good assortment of excellent radio rectifying mineral material may be obtained merely at the cost of keeping one's eyes open.

Not every specimen found will be radio-sensitive, but if a fair number are collected there should be at least one really crystal amongst them.

form of a round disc. This disc supports the crystalline mass. In the 'phones the mass in the small space has to perform large oscillating movements, but in the loud speaker the large surface covered with the powder executes only small vibrations. The strength of the sounds is proportional to the size of the disc, and so it is only necessary to enlarge the disc to magnify the sound emitted by the loud speaker.

The clearness of reproduction is surprising. In full orchestral pieces every single instrument can clearly be distinguished. No distortion, no cracking, and no clattering sounds are to be heard. The loud speaker fills a large room with a tone of great beauty and purity.

AERIAL PULLEYS.

WITH the approach of the time when the back garden plots will be recognisable once again, our minds turn to that outdoor aerial which we had decided to erect.

A source of annoyance in connection with this operation is the aptitude of pulleys to allow the wire (or rope) to slip off the wheel and jam, so that the wire cannot be moved one way or the other. A simple way of avoiding this bother is to drill a hole in each side of the pulley block and insert a split pin. If care is taken to see that the pin is close up to the wheel the aerial may be run up or down without fear of jamming, even though there should be undue clearance between the wheel and the sides of the pulley block.

SWITCHING IN VALVE CIRCUITS.

USEFUL ARRANGEMENTS FOR THE AMATEUR.

By G. V. COLLE.
(Technical Staff.)

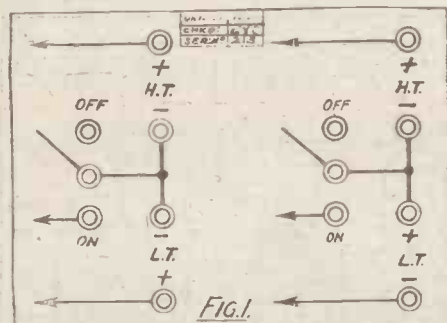
WHILE the following circuits incorporate switches of the knife type, yet the majority of them can be adapted to other well-known switches, such as the Dewar rotary, "Utility."

For the purpose of this article, however, the knife switch has been chosen, partly owing to its simplicity and cheapness, and

ously. To do this the switch must be placed in the L.T. lead, which is joined to - H.T.

Another useful switch is that which changes 'phones over for loud speaker. This is shown in Fig. 2. The fixed condenser is placed either across the 'phones or loud speaker, according to the position of the switch.

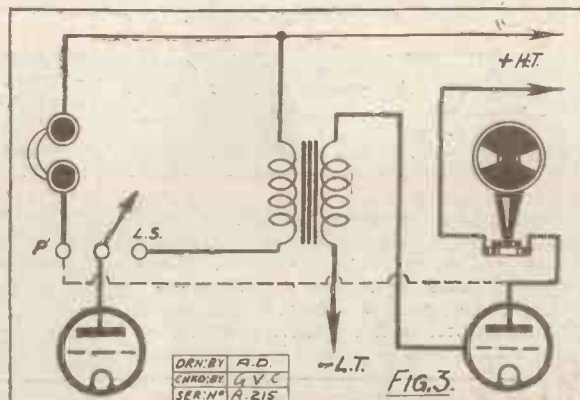
plug must be employed. A switch is the more convenient, however, and one wired up as shown in Fig. 6 is a very useful addition to the set.



partly owing to the fact that it is recognised as the most useful of all switches used in wireless sets. It is the aim of the article to describe various general switching

L.F. Switching.

In Fig. 3 the S.P.D.T. switch is so arranged that when the last valve (L.F.) to which the loud speaker is attached is cut out, a pair of 'phones are substituted in the plate circuit of the previous valve instead. If, however, the reader desires the loud speaker, but to give a smaller volume, the 'phones can be eliminated, and a wire taken, as shown in the dotted connection. With the former arrangement, in Fig. 3, however, it is



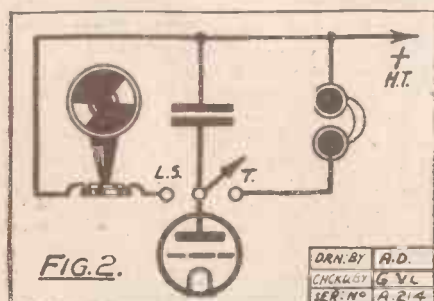
In Fig. 7 a D.P.D.T. switch is employed for changing over from an ordinary aerial to a frame aerial. The centre coil, which is the reaction, can either be coupled to the coil in series with the frame or else to the A.T.I., according to the aerial used.



A 30 watt field set in operation during recent Army manoeuvres.

arrangements which are always of use in the amateur's set.

Fig. 1 shows a S.P.D.T. switch for cutting off the L.T. and H.T. simultane-

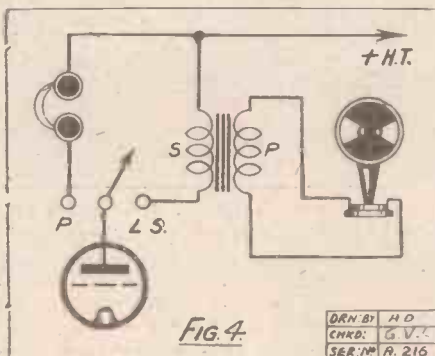


possible to keep the same H.T. on each valve without the aid of multi-contact switches.

To change over from a low resistance loud speaker to a high resistance pair of 'phones is the object of Fig. 4. Similarly, the same arrangement can be applied to two pairs of 'phones, one pair of low and one pair of high resistance. If a 'phone distribution board is used it is an excellent plan to fit a series-parallel switch on it. The wiring of this is given in Fig. 5

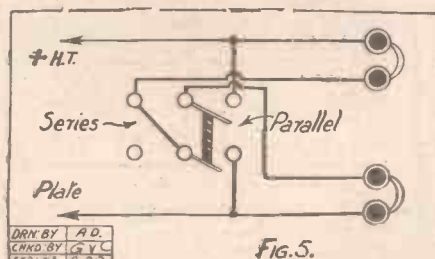
Reverse Reaction Switch.

When an H.F. valve is cut out the direction of the current in the reaction coil is reversed. Consequently, to bring it back to the right relation with regard to the coil to which it is coupled, a switch or reversing



To the experimenter, the arrangement in Fig. 8 is well recommended. The action of the switch in this case is simply to change the grid leak L.T. connection from negative to positive, so that the best

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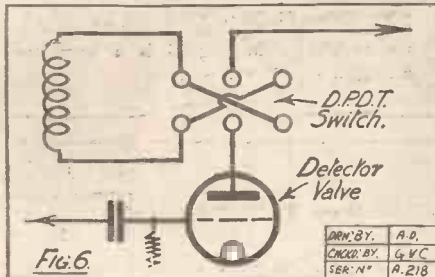


SWITCHING IN VALVE CIRCUITS.

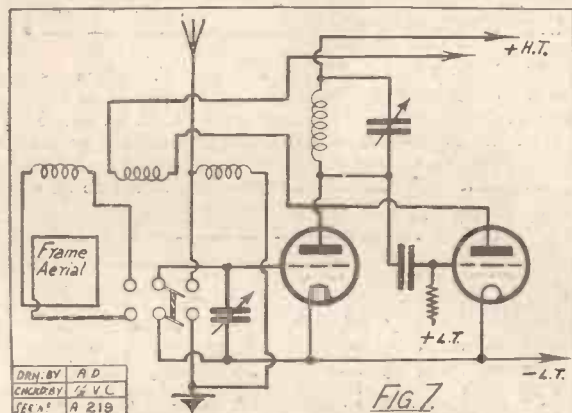
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arrangement can be found for the particular valve or circuit in use.

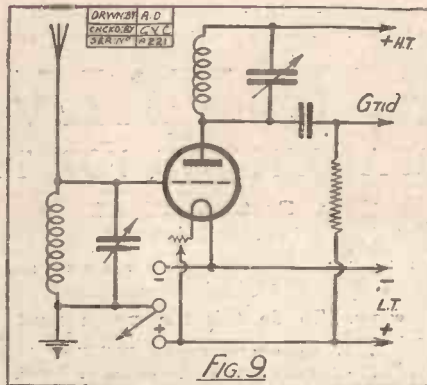
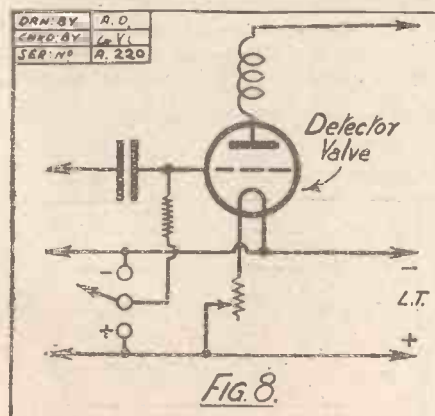
Ranking next in importance in this respect is the refinement shown in Fig. 9. The action of the switch in this case is to



connect negative or positive L.T. to earth. The factor which determines which side shall go to earth is the valve. Some makers state that the "grid return" should be positive because the valve functions best with a positive potential on



its grid, but in any case the listener should prove this for himself, and he can easily do so if he uses this switch. This switch, or even the one mentioned before, is not recommended on a set where best results have previously been obtained by trial,

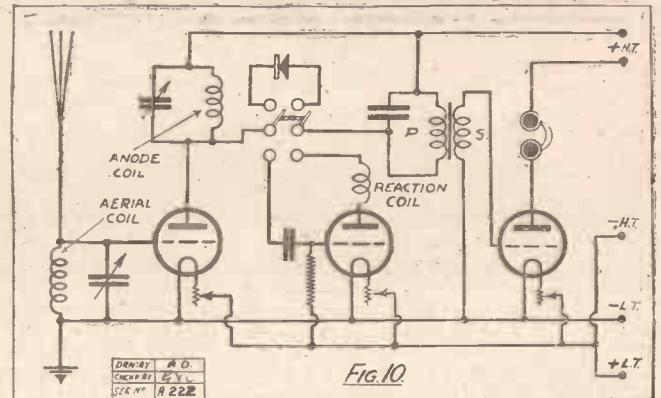


but they are certainly recommended where the reader contemplates building an experimental set and intends trying out different types of valves and circuits.

A D.P.D.T. switch is put to useful work in Fig. 10. By it either valve or crystal rectification can be used as desired.

The anode coil in this set should occupy a central position on a three-way coil holder, aerial coil being on one side and reaction on the other (both moving).

When the valve is being utilised as rectifier or detector, the reaction coil can be coupled to the central coil (anode) and the aerial coil placed at right angles to it. The aerial coil is coupled to the anode coil when the crystal is used as rectifier, as the reaction coil is then cut out.



Now, it often happens that the owner of a portable receiver favours the latter type. It may be because he desires to give a little exhibition of "all novel" gadgets, or it may be because he is under the impression that such an "aerial" conforms with other features of compactness and general convenience in transport; however, such a choice is a great mistake, for under ordinary circumstances this type of aerial is obviously unpopular on account of its inefficiency, and if the more orthodox single-wire aerial gives the best results at home why should it be discarded when using a portable set, at a time when it is particularly important that one should have no doubts whatever regarding aerial efficiency?

Single Aerial Best.

No type of "wound" aerial can be as efficient as a straight length of wire. It is

true that good results can often be obtained from a freak aerial when using a super multi-valve receiver, but where the average single or two-valve set is concerned such a device is most unsuitable, especially when tuning the set to the high wave-length of 5 X X.

There is no doubt that the ordinary single-wire aerial is the very best proposition under almost any circumstances, and, I would add, especially where single-valve portable sets are concerned. There is little or no advantage to be gained by increasing the length beyond the usual 100 feet limit, even when tuning to 5 X X, and many portable-set owners who sometimes give way to that "let loose" feeling, and think that an extra 50 feet or so will improve matters, will do well to bear this in mind.

Frame Aerials.

A well made collapsible frame aerial, if mounted on a suitable stand, will give good results with certain types of two- and three-valve receivers. The only real advantage with a frame aerial is its directional properties, and when one considers that the same desirable effect may be obtained by erecting a single-wire aerial "end on" to the broadcasting station, an operation which presents no difficulties in a clear open field, then why bother about a frame aerial when, at its best, it gives inferior results.

It is a mistaken idea to imagine that if a frame aerial is stood, for example, on the top of a car, out in the open, it will give far better results than those obtained at home, when surrounded by four walls. If it must be used then see that the receiver is suitably designed to work in conjunction with it.

CONCERNING PORTABLE AERIALS.

By O. J. R.

THE simple single or double wire aerial is, so far, the most satisfactory conductor or "collector" of the radio-frequency currents which operate a wireless receiver, and this is an obvious fact, for one finds very few other types in common use to-day.

The majority of receiving aerials in this and other countries are of the single or double wire variety, and therefore when one speaks of an outdoor aerial reference is invariably made to the common horizontal wire conductor. The popularity of various types of aerials used in this country may be tabulated in the following order: Outdoor aerials, single and double, 80 per cent; indoor aerials, including frame aerials, 18 per cent; other types such as cage aerials, "freaks," etc., 2 per cent.



NOTHING could be more instructive to the man desirous of acquainting himself with the many resources at the disposal of up-to-date broadcasting than a visit to the new studio at the Voxhaus Broadcasting Station of Berlin.

The way this studio itself is fitted up is unique. The task of providing satisfactory acoustic conditions in a studio, of course, involves many problems not met with in the theatre and which, on account of the rapid progress of wireless broadcasting, could not always be given sufficient attention.

When broadcasting commenced in Berlin, on October 29th, 1923, the Funkstunde Company, for instance, had a relatively small room at its disposal, a room of 26 sq. metres area and which, at most, could accommodate but 25 musicians and a few soloists. A year later, a large hall of 92 sq. metres (14 metres long, by 6.60 metres wide) was provided on the fifth floor of the Voxhaus. However, even this larger studio proved inadequate, it being found necessary to have two spacious halls available on account of rehearsals, etc. The new studio recently inaugurated is 18 metres long by 9 metres wide (162 sq. metres). Apart from its remarkable size, it is noteworthy because of the new acoustic principles for the first time adopted in its installation.

A Special and Exclusive Article by

Dr. ALFRED GRADENWITZ
(Our Correspondent in Berlin.)

ples for the first time adopted in its installation.

Studios so far had been more or less hermetically isolated, while the sound energy produced inside was "blanketed" and thus disposed of. Speakers in such rooms hardly hear their own words, musicians are unable to recognise their playing, and the conductor of the orchestra no longer perceives the play of each of his men.

Dealing with Echoes.

This is why Mr. F. G. Knoepfke, Director of

metres) of the hall. At the same time, the various tests showed that the old principle of sound smothering could not wholly be given up, as otherwise resonance might result in excessive sound effects, and a partial smothering by light curtains and by "flies" was eventually resorted to.

The wainscoting is made of gaboon, a



Fig. 1.—The "flowing water" noise machine.

the Berlin Broadcasting Company, for the first time gave up the old way of hanging up heavy curtains everywhere, and instead provided a suitable wainscoting, without, however, wholly doing away with acoustic insulation. The first tests gave quite satisfactory results and, as shown by numberless letters, created somewhat of a sensation among broadcast listeners.

When the scheme was first discussed, there were, of course, many sceptics to draw attention to the inadequate height (3.20

material similar to mahogany, and is 7-fold three-ply. This material was chosen on account of its easy treatment from a technical point of view, and because of its suitable hardness. The massive floor has a linoleum lining and is, moreover, covered by a large Bouclé carpet. Ventilation is effected by shafts reaching far beyond the roof and terminating there in a discharging device.

The Special Organ.

Another feature of the new studio is the large organ combined with an harmonium installed a short while ago but which has not yet been fully tested, though preliminary tests would seem to indicate satisfactory results.

Mr. Knoepfke eventually contemplates equipping his new station with a number of technical installations providing additional acoustic possibilities and thus enhancing the effectiveness of broadcasting.

(Continued on next page.)



Fig. 2.—The relaying apparatus at the Berlin Opera House.

BERLIN'S NEW STUDIO.

(Continued from previous page.)

Fig. 1, for instance, illustrates a flowing water arrangement which enables the noise of actual rain to be imitated with remarkable accuracy. By opening the taps

the most varied noises, such as rain, the dashing of waves, a waterfall in the mountains, etc., are obtained.

Fig. 5 shows the new device in actual operation, and Fig. 3 a machine which imitates the noise of a ship's pro-



Fig. 3. Simulating the sound of a ship's propeller.

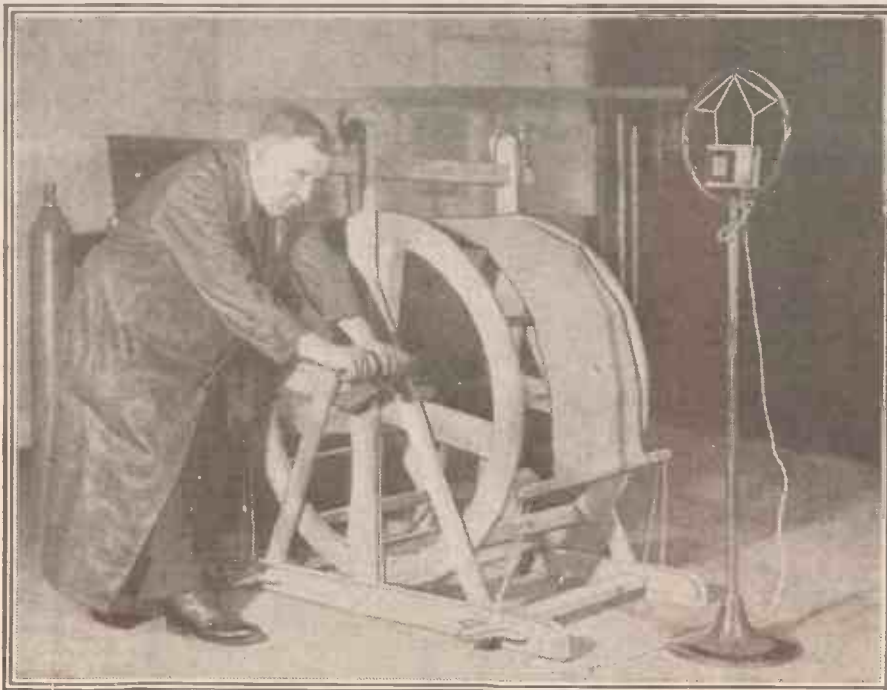


Fig. 4. This machine produces the sounds of anything from a gentle breeze to a thunderstorm.



Fig. 5. "Synthetic" rain in the course of production.

PELLER. The heading photograph shows a number of devices for producing the most varied noises, table bells, telephones and signal horns, etc. To the right is seen the "Apparatus of 1,000 Noises," which combines practically all imaginable noises, from

the bleating of goats, the braying of asses, the creaking of doors, the clinking of breaking glass, and the rattling of carts, to the sounds of church bells, chimes, sleigh-bells, cow-bells, etc., each of which is produced by operating a lever. The oxygen cylinder to the left is used for producing the illusion of the noise of steam discharging from a locomotive. Alfred Braun is seen standing near the microphone.

The Opera House Microphones.

Fig. 4 shows a wind machine in operation. This comprises an open wooden drum having a piece of cloth stretched out loosely over its circumference and fixed on both sides by strings to the frame. As this drum is turned round, the spokes will come into contact with the cloth, thus producing the noise of wind. According as the drum is rotated slowly or at greater speed, all the gradations between a soft breeze and a thunderstorm are imitated.

While dramas and comedies as well as operas and operettas are regularly broadcast direct from this studio, the Voxhaus Station has made the relaying of performances from the Opera House and other theatres a regular feature. There has even been some talk lately of starting a special broadcasting theatre, the performances of which, while being at frequent intervals relayed from the Voxhaus Station, would every night be accessible to broadcast subscribers at reduced rates.

Four microphones are used. Two are situated in concealed positions among the footlights in the front of the stage, and two are placed among the orchestra. Any one or any number of these microphones can be used as desired. In Fig. 2, the engineer on the right is controlling the microphones and amplifiers, while the other is telephoning instructions to the transmitting station.

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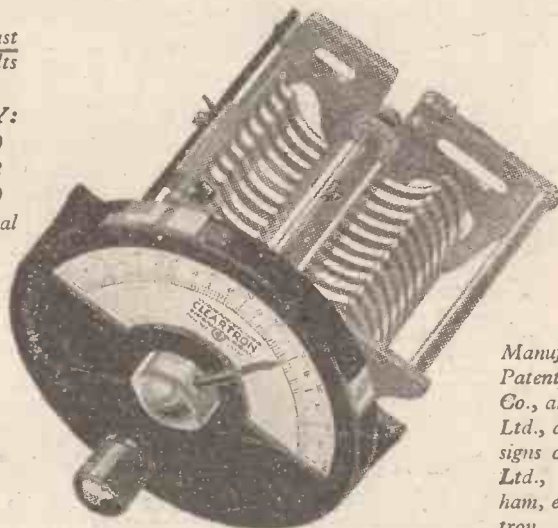
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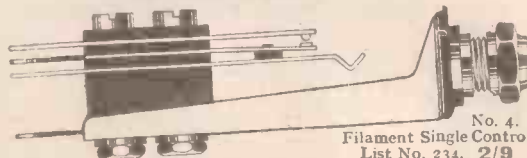
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BROADCAST NOTES.

By O. H. M.

The Government on Broadcasting—A Runnymede Broadcast—"Talk Merchants"—Offers to B.B.C. Officials—The Daventry Experimental Station—Reflections on the Derby "Stunt."

It must have amused the people at Savoy Hill to observe the continuation of the controversy a full fortnight after the so-called "editorials" had been abandoned, according to plan. Of course, the enemies of broadcasting are only too anxious to exploit possibilities against it, but on this occasion I think they have come off badly in the argument. Captain Ian Fraser's intervention was timely and effective.

The Government on Broadcasting.

There is a recrudescence of rumours which seems to point to an earlier introduction of the broadcasting legislation than was contemplated. I have not been able to secure confirmation, but I am disposed to believe that the Government will table a short measure on broadcasting about the middle of July. Beyond the fact that this measure will endeavour to embody the principles recommended by the Broadcasting Committee I am unable to forecast it. I can make a shrewd guess, however, that the procedure of introduction will be carefully arranged so as to keep Parliament off detail. This course has some advantages, but it also has some dangers. For instance, a full parliamentary discussion might guarantee the acceptance of the principle "no restrictions, no privileges," which is the only sound principle on which the British broadcasting service should be developed. I am a little anxious that if the summary procedure is overdone, certain restrictions might be imposed which listeners subsequently would resent.

The formula "no restrictions, no privileges," should work out admirably. Under it, the B.B.C. would get all the licence money over and above the actual cost of collection. Theatres, music-halls, and the concert industry could negotiate with the B.B.C. in the ordinary business way, and on a basis of equality. The newspapers would be able to continue to control B.B.C. policy in so far as the distribution of news is concerned, for the simple reason that the material for the broadcast bulletins must still come from the Agencies. I know that some influences are at work to penalise the new B.B.C. by the imposition of numerous restrictions in its permanent constitution. All that I can say about such a policy is that it can only succeed even temporarily by stealth and subterfuge, and the reaction it will induce will more than defeat the intention of its sponsors.

A Runnymede Broadcast.

I am glad the B.B.C. are making a special O.B. of the ceremony at Runnymede on June 20th in commemoration of the signing of Magna Charta. Massed choirs, brass bands, and an address by the Lord Chief Justice provide varied broadcasting material.

"The Ephesian Matron," the famous 17th century comedy by Diddin, has just been re-discovered in the British Museum,

and arrangements are being made to have it broadcast at an early date. This will be its first revival in 200 years.

"Talk Merchants."

Readers of these notes will be familiar with most of the main cross-currents which ultimately shape the policy of the B.B.C. programmes. The "talk-merchants" after a heavy hitting innings since the beginning of this year, have just sustained a severe reverse. Fortunately for the B.B.C. this has come from within. I happen to know that the announcement of the reduction of talk for the summer months was made only a few days before a heavy and sustained attack was due to be made by a group of newspapers. So far so good. What is happening is that after the end of this month and until October we shall have about 30 per cent less talk. The reduction is inadequate, and it should be starting at



This is a three-valve receiver built up in accordance with "P.W." Blueprint No. 20 by Mr. G. Jones, 12a, Mount View, Bells Hill, High Barnet.

once. By delaying until the end of June the B.B.C. will be losing a lot of the new listeners gained during the Emergency period. But above all, we must be on the alert against the Broadcasting Commission trying to add more and more talk and instruction to the programmes next winter.

The success of the special musical recitals at 7.25 every evening is definitely established. I hear that another series of similar recitals will be put on from 9.45 to 10 nightly. This is good news. There has been too much talk between 9.30 and 10.15.

Secret Wireless, Ltd., is again on the move, with a view to getting a special concession squeezed into the broadcasting legislation. This will be probably the last challenge of competitive broadcasting for a period of at least ten years. It has no chance whatever of success.

Emissaries of American broadcasting concerns are now in this country with the double object of getting new ideas and recruiting staff. The latter is the chief purpose, but in view of the strict regulations of the United States immigration laws, it cannot be advertised with impunity. But I know of some tempting offers being made to B.B.C. officials. The uncertainty of the future here makes it easier for the Americans to succeed in their purpose. It will be a pity to see some of our best men go, but money talks, and there are not very bright prospects for the individual in British broadcasting. So far as I can see, it will have all the disadvantages and very few of the advantages of the Civil Service. Thus there are to be no permanent appointments, and the scale of pay will remain lower than in any Government department, and of course far lower than in any business concern, big or little. This is all unfortunate but inevitable until the Post Office steps sitting on the funds paid for programmes and for decent conditions for programme builders.

The Daventry Experimental Station.

Rapid progress is being made with the new experimental transmitter at Daventry, and this should be ready to work early in October. If the initial experiments succeed, and there seems no reason to doubt that they will, then the listeners in the Daventry zone will be receiving their first genuine alternative programmes by November 4th. The position with regard to the other instalments of the new distribution scheme is considerably improved since I last gave an account of it. Some progress has been made, although there are several high hurdles of official obstruction yet to surmount.

The Derby "Stunt."

I hear the Derby broadcast was a bitter disappointment to many listeners. The B.B.C. post-bag has included a good number of angry epistles. The whole point is a misunderstanding of what the B.B.C. can do honourably in a broadcast of the kind. People do not seem to realise that the B.B.C. has certain definite contractual obligations to observe. One of these is that normally no news can go out before seven o'clock. Another is that if a microphone is put near the boat-race or the Derby or any other similar event, the B.B.C. is prohibited from giving any narrative or running commentary or an announcement of the result. The idea of these broadcasts is to give the noises and thus to produce an impression of the atmosphere. Well, this year's Derby was run in pouring rain. There was hardly any noise, and the broadcast was therefore a wash-out. I think the B.B.C. would be well-advised not to undertake any more of these purely "atmosphere" stunts. They only feed-up the vast majority of listeners and make unnecessary enemies.

A GOOD battery if properly treated will last for years. Now that a very large percentage of listeners charge their own accumulators and even H.T. batteries, the following suggestions on the care and maintenance of such batteries will be found very useful.

The battery manufacturers all issue instruction books covering the care of their batteries, but few owners appear to give them more than a passing glance. The modern accumulator requires so little care and attention, that some amateurs think that it will operate without any care at all. The writer has heard listeners boast that they have never examined their accumulator in the year or so that they may have had it.

A battery will stand a lot of abuse, and will continue to give service for a long time until at last the acid level gets so low—by evaporation of the distilled water—that it has to give up the struggle, and by this time the battery is seriously damaged.

Only the parts of the plates that are covered by the acid solution are being charged. Charging systems are designed to keep a battery charged that has all the parts of the plates covered. If the acid falls very low so that only a portion of the plates are covered, it means that the parts covered are receiving an excessive charge, and a battery used in this way for any length of time will be ruined by sulphation, or at least partially shorted.

Sulphating.

Even if you do not charge your own accumulator but take it to a battery charging station, it should have the same careful treatment and be examined periodically.

If a battery has been neglected for some time, it is a good idea to take it to a battery-charging station and let them give it a long slow charge. If a battery that has been allowed to become badly sulphated is charged at the normal rate, it will not do it much good. A sick battery requires skilled care. †

In any case, a good battery-charging station has the instruments that enable them to tell the exact condition of the plates, and it will be wise to leave it to them to do what they can to bring the battery back to life.

Fully 90 per cent. of all battery troubles could be prevented if about once every two weeks distilled water is added to each cell, and at the same time they are tested with a hydrometer. The hydrometer tells you if the battery is charged or not, and gives you a check on whether your charger is working properly. When fully charged the hydrometer should read between 1.280 and 1.300. If any cell shows a reading of 1.250 or less, you should have a special charge.

THE CARE OF L.T. & H.T. BATTERIES.

From a Correspondent.

Distilled water can be obtained from a chemist; an alternative is to boil ordinary tap-water, allow to cool, and then carefully filter so as to prevent impurities in the water getting into the acid.

Under no circumstances should ordinary tap-water be used without treating it in this way. The liquid should always be kept just about one-quarter inch above the tops of the plates.

The Hydrometer.

The best hydrometer to obtain is one having a fairly long piece of rubber tubing attached to the outer container of the hydrometer, and this casing should be large enough to allow the hydrometer itself

coming in contact with clothes, tables, etc., but also minimises the chance when the accumulator is "gassing" or the acid bubbling over and causing damage to linoleum, carpets, etc.

Do not on any account use any "dope" in your battery. There are a number of these preparations that are supposed to be guaranteed to bring old batteries back to life; but investigation generally shows them up as simply strong sulphuric acid solutions.

During the months when your accumulator has very little work to do—i.e. the summer months, as probably you do not use your set quite so much as in the winter, do not forget that if your accumulator has to have the maximum length of life it must still be charged during these months, although perhaps not so frequently.

TECHNICAL NOTES.

(Continued from page 574.)



The "panel-room" of the new broadcasting station at Rome.

design of transformer is described in which low-leakage inductance and self-capacity are ensured by a sectionalised and spaced construction, and a curve of amplification of this transformer is given. Various questions relating to intervalve transformers are briefly considered, and circuits are described for increasing the amplification of low frequencies and the effective step-up ratio of a transformer. The use of low-frequency reaction for correcting distortion is described and illustrated by measurements.

The paper represents an exhaustive and valuable investigation of the theory and practice of low-frequency transformers, and should be consulted by all those who take a serious interest in this subject. At the conclusion of the paper is a short discussion of the choice of a valve and a transformer in relation to one another, a subject on which there seems, particularly at the present time, to be great diversity of opinion.

The Ultra Short Waves.

According to Dr. E. O. Hulbert of the United States Naval Research Laboratory, who has carried out a number of important investigations in connection with short-wave transmission and reception, the wavelengths below about 10 metres pass off "into the infinite," and are therefore practically useless for purposes of terrestrial communication. Contrary to popular opinion, Dr. Hulbert also considers that waves in the neighbourhood of 200 metres are not efficient for purposes of broadcast transmission.

easily to find the correct level, without coming in contact with sides of the container. When taking the reading be careful that acid does not drip through the end of the rubber tubing on to your clothes.

Watch the battery terminals to see that they are not sulphated; if they are, remove and scrape clean. Badly sulphated terminals should be boiled in a strong solution of soda and water, after this they should be smeared with a little vaseline. If the terminals are sulphated it sets up a high resistance joint which will give rise to parasitic noises.

To prevent any leakage of the accumulator in cases where rectifiers are used as a source of charging, the accumulator should be arranged by means of a switch so that it can be entirely isolated when not being charged or discharged.

Preventing Acid Damage.

When the accumulators are actually on charge it is a good plan to place them on an old tin tray, or, better still, in the scullery sink. This not only prevents acid from

CERTAIN newspapers seem to have just discovered the fact that the reason (or one of the reasons) for the rather ordinary broadcast programmes served out by the B.B.C. of late is the lack of money.

This may seem rather an astonishing reason when it is borne in mind that the B.C.C. receive something like half a million of money a year, plus what profits they make from the "Radio Times," etc. But half a million of money for running such a broadcasting service as we have in this country is none too much. Listeners, perhaps, do not realise the enormous fees which well-known artistes can command to-day.

£1 a Minute.

There was an example the other day in the person of Mr. Billy Bennett, the comedian, who made such a success at the Royal Performance at the Alhambra. Mr. Billy Bennett was offered a pound a minute for a fifteen or twenty-minute broadcast, but he turned this offer down as he did not consider it was good enough. Compared with what he can earn in the music-hall world, we suppose a pound a minute must seem a very small sum of money to him. Personally, we consider that there are very few comedians with sufficient versatility to amuse the public by wireless who are worth anything like a pound a minute.

Because a man is a success on the music-hall, it does not necessarily mean that he will be a success on the wireless. No doubt the B.B.C. are better judges of what will make a funny broadcast than we are, and we suppose they had pretty well summed up Mr. Billy Bennett's potentialities as a radio humorist; but even then, a pound a minute for a fifteen-minute broadcast is not to be sneezed at, for Mr. Billy Bennett—despite his assurances that he does not seek any more publicity—must, as a business man—and all music-hall artistes are more or less business people—realise the extraordinary value of broadcasting to artistes who have just blossomed forth into fame.

Mr. Billy Bennett scored a well deserved success at the Alhambra, and he received, in the newspapers, some very excellent publicity, and to-day he may be regarded as one of the leading lights on the music-hall stage.

A Great Chance.

But the public mind in such matters is apt to be very forgetful. Mr. Bennett, we believe, is about to fulfil a touring engagement abroad. When he comes back he will need as much publicity as he can get. Other humorists may have come along and attracted the attention of the public; one has to be a very old favourite indeed to leave one's public for a length of time and to come back and immediately jump into popular favour.

A fifteen minutes' broadcast would have given Mr. Bennett the chance of indelibly stamping on the minds of hundreds and thousands of listeners the idea of his characteristic humour. The chances are that they would not have forgotten him for a very long time; he might have served for many months to come as a standard of comparison in the minds of listeners. Having heard Mr. Bennett, they might have been so tickled by his humour that, when another humorist broadcast who was not so good, listeners might have said: "Oh! this man is not a patch on Billy Bennett," and the name Billy Bennett would have become,

CURRENT TOPICS.

By THE EDITOR.

Programme Money—Chaliapine's Suggestion—Artistes' Fees—Summer Radio—Popularity of Portable Sets.

perhaps, a household word as regards radio humour.

We are sure that Mr. Bennett will not deny the value of such publicity and we hope that if the B.B.C. approach him again, he will not turn down their offer, because the B.B.C., quite naturally, are unable to pay him fees in proportion to those he can earn on the music-hall stage.



The fourth operator of the new liner s.s. "Hamburg" varying the wavelength of the ship's aerial.

Chaliapine's Idea.

The fact is the B.B.C. have spent such a lot of money in getting together the finest broadcasting chain of stations in the world, and they have got to provide new programmes and new artistes for all these stations many times a week, that it is not to be wondered at that they cannot offer to pay fees of £1,000 or so to artistes, however good they may be.

There have been exceptions, of course. Chaliapine was given one thousand guineas, we believe. Chaliapine suggested to "Ariel," who interviewed him the other day (and the result of this interview will appear in "P.W." very shortly), that he was very well satisfied with the treatment he received at 2 L O as regards finance! He quite realised that engagements for broadcasting could not

occur very frequently in view of the high fees he would want, but he suggested that listeners should pay a little extra for special broadcasts of this nature, and that they should send to the B.B.C. contributions to a fund for providing extra specially high-class talent: these contributions to be in the form of 1d., 2d. and 3d. stamps.

Summer Radio.

If a million listeners sent in such contributions to the B.B.C. then one could imagine quite a nice amount of money being collected to be spent specially on improving the programmes by engaging high-class talent. We believe this has been done in America with more or less success, and it certainly might be worth trying in this country. We commend it to the attention of the B.B.C.

Since broadcasting began there has been a general belief in the radio industry that a spring slump in the radio trade is inevitable. This year it is encouraging to note that

the spring slump is not so serious as it might be, as the trade figures at the height of the winter demand and during the spring and early summer months this year show far less falling off than was the experience in the early days of broadcasting. This is no doubt due to the steady increase in the number of listeners who, despite continual criticism, seem to appreciate the B.B.C.'s service.

Portable wireless sets this year are going to be popular, by the look of it. The trade has made great improvements in portable sets. Not so very long ago they used to be very cumbersome and heavy, and generally unsightly. Nobody wants to saddle himself with a half-cwt. wireless set when going into the country for a picnic, or a day on the river, but if one can take a neat attaché-case containing a wireless set, with the know-

ledge that within 20 miles of a station one can pick up the programmes, then the attractions of wireless are emphasised.

We have already published a "B.C.T.-Way" book on portable sets which has met with an enormous demand. This is a clear indication that hundreds and thousands of amateurs in this country are interested in portable sets, and from information we have gathered from the trade we understand that the sale of portable sets this summer has also shown a very marked increase over the sales last year and the year before. No doubt greater improvements still will be made next year, though whether the day will ever come when the pocket receiver will be an accomplished fact for reception at a distance of, say, 20 miles from a broadcasting station, we cannot say, but all things seem possible in wireless.

A SELF-CONTAINED TAPPED COIL.

By OSWALD J. RANKIN.

THE following suggestion may be of some interest to amateur constructors who are on the look-out for some little idea presenting a little scope for experiment and possible development. The proposition, as shown in the sketches, is a combined tapped coil and tapping switch, the coil being of the cylindrical type, fitted with an ebonite end disc carrying the switch studs, which are arranged in radial formation. Six pairs of studs will be required for a coil having six tapplings (counting end of winding as last tapping), and they should be connected as shown in Fig. 1, where it will be seen that every alternate stud is connected, via a common lead, to the beginning of the coil winding, and that the adjoining studs are connected to the tapplings.

The Device in Operation.

Two spring brass contact arms, A and B, are attached to a permanent ebonite block and made to engage one pair of studs at a time, the strip A being always in contact with the beginning of the coil winding, and the strip B with either one of the selected tapplings. The setting shown in Fig. 1 indicates that the whole of the winding is in use; if the coil and disc are rotated to the next setting clockwise, the

terminals, which also hold the contact strips in position (see upper sketch). The tapplings are passed down inside the coil and soldered to the shanks of the studs before clamping the two discs to the ends of the coil, the stud connections to the beginning of the winding being made at the same time.

Additional Refinements.

Some form of stop or locking device will be necessary when revolving the coil. An effective method of arranging this is indicated in the lower sketch, where (in the case of a coil having six settings) an hexagonal brass plate is soldered to the end of the spindle and set accurately so that one edge of same engages a flat brass spring when the two contact strips are resting directly upon any one pair of studs. The spacing of the studs will depend upon the width of the contact strips, or vice-versa.

If the strips are allowed to fall between the studs every time an adjustment is

made, results will be very disappointing; the best plan is to let the studs well into the ebonite disc, so that the faces of same are almost flush with the face of the disc. The manipulating disc might be marked off into sections, each section representing the number of turns at the given setting. A small pointer, mounted on the bearing pillar at that end of the coil, could be arranged to indicate the number of turns in use.

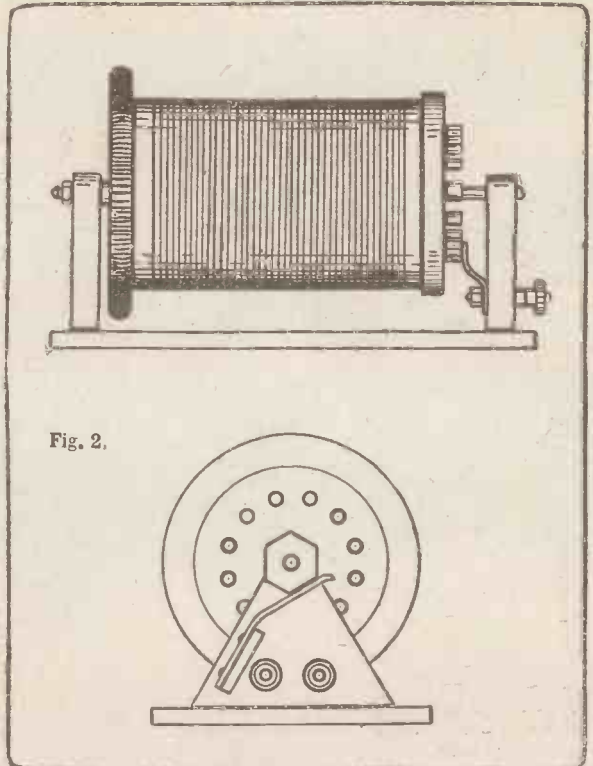


Fig. 2.

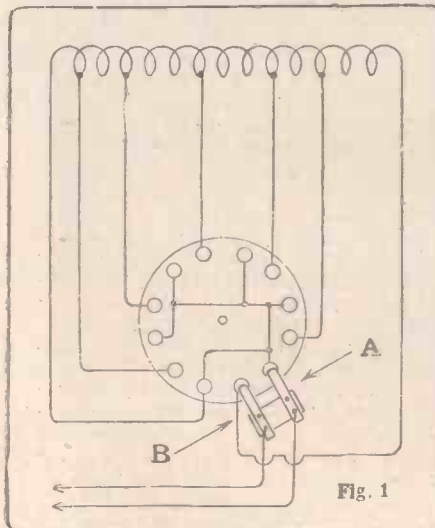
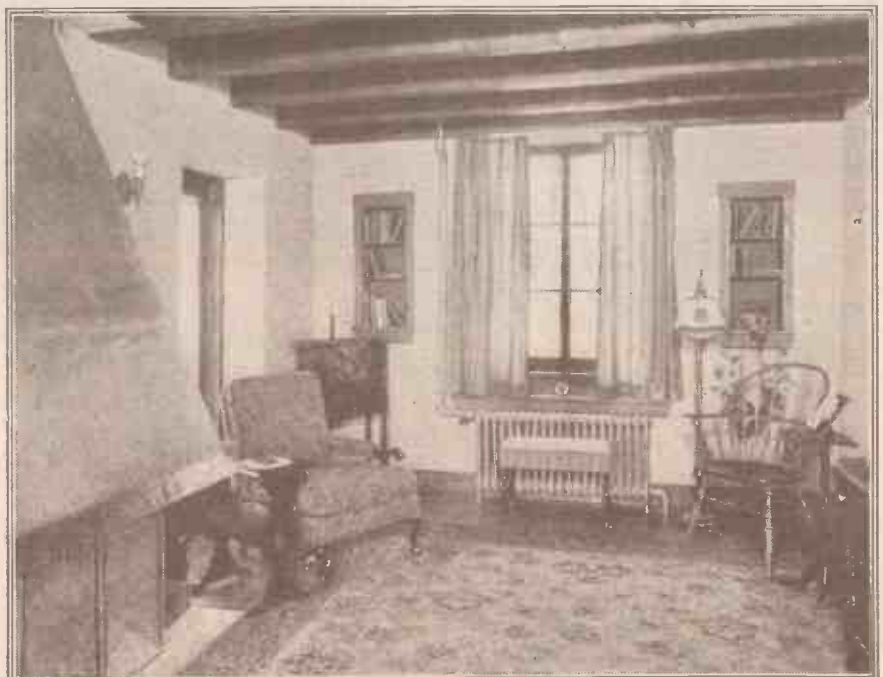


Fig. 1

fifth tapping is brought into use; and if we make an adjustment from the given setting to the next pair of studs on the left (anti-clockwise) the coil is tapped at the first tapping, and so on.

Fig. 2 shows a practical method of arranging the device. The manipulating disc at the back end of the coil, and the two upright bearing pillars for the spindles may be of wood, one pillar being provided with two holes near the base which are bushed with ebonite to take two ordinary



The sitting-room of the American radio house on Staten Island, which was opened recently by Captain Ecksley. A loud speaker can be seen in the corner.



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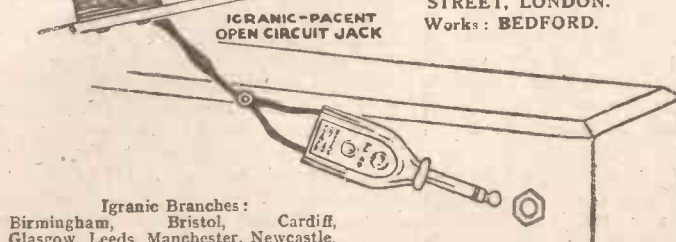


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"WHY I DON'T LIKE BROADCASTING."

By LIONEL POWELL (*In an Interview with "ARIEL."*)

Mr. Lionel Powell, of Lionel Powell and Holt, is one of the best-known concert agents in the world, and as such he has been closely associated with the problem of world-famous artistes broadcasting for the B.B.C. and the effect on the concert industry. Although we fail to agree with many of Mr. Powell's views, we welcome the opportunity of including in the impartial columns of "P.W." the reasons why Mr. Powell does not like broadcasting.—The Editor.

TEN thousand people were applauding Paul Whiteman's masterly rendering of "Dreaming of a Castle in the Air" at the Royal Albert Hall when Mr. Lionel Powell, under whose aegis the famous band was appearing, turned to me and said: "I shall be glad to give you my views on broadcasting. Let us go to my office."

A few minutes later I was comfortably seated in the handsome offices of probably the best-known concert artistes' agency and management in the world. Among the many famous artistes under Lionel Powell and Holt's management may be mentioned Dame Nellie Melba, Kubelik, Madame Tetrassini, Paul Whiteman, Kreisler, Dame Clara Butt, and very many others.

Mr. Lionel Powell frankly does not like broadcasting. He may be prejudiced in his views and, though he has cause for complaint, his opinions are of such sound reasoning that the Editor of POPULAR WIRELESS has deemed them worthy of publication as a matter of interest to our readers.

"Of course, I have the deepest respect for wireless as a science," Mr. Lionel Powell told me, "but as an entertainment I do not like it at all. In fact, I consider it harmful to many branches of the concert business."

A Dull Audience.

"I was one of the first to appreciate the advent of broadcasting as a science, and I realised how important a world factor it would become. I follow its developments with the greatest of interest, and when anything new has been discovered in radio, I am just as eager to know about it as the keenest wireless enthusiast."

Mr. Lionel Powell then expressed some very candid opinions on broadcasting.

"Wireless broadcasting has many drawbacks," he began. "One of the greatest, I think, is that the true artiste cannot be at his best before such a dull audience as the microphone and padded and curtained walls!"

Lionel Powell and Holt have many great artistes under their management, and one and all feel that they cannot give their best without a visible audience.

"They would rather face the severely critical ten thousand at the Albert Hall than the hundreds of thousands they cannot see or hear. Whereas their visible audience urges them to do their best, radio listeners and the high tension of the room from which they broadcast bring to the fore all their nervousness, and the result is the unpleasant sensation of

renewing their acquaintance with their old enemy, 'stage fright.'"

While many of the artistes do not wish to broadcast, others are not so particular, and, in fact, rather enjoy the experience. To-day it is nice to be able to say, "I have entertained an audience of one million odd!"

There is a clause in each Lionel Powell and Holt contract which prevents the artiste from broadcasting while under their management. Mr. Powell gave me



A room in a typical American house, showing the eight valve "super-het." and frame aerial which is in use.

some of the reasons for this rather severe agreement.

"Broadcasting," he said, "is one of the greatest enemies of the successful concert. While excerpts of plays may add to the receipts of the box-office, it is exactly the opposite in our case. Our big concerts usually take place on Sunday, a day on which most people like to stay at home or go for a ramble in the country, but certainly not go to an entertainment if they can help it."

A Case in Point.

"If these concerts were broadcast, everyone—or, at least, a great majority—would stay at home and listen-in in comfort. But if Melba is singing, and not broad-

casting, the public will travel hours on end to be able to hear her."

"I remember on one occasion we had to allow a famous singer to broadcast. The usual advance publicity was made, and in consequence our receipts were over fifty per cent. lower than at a concert at which she did not broadcast."

"Broadcasting is such a cheap form of entertainment that those who can hear Jones without extra cost prefer to do so than going to the expense of booking seats and the luxury of taxi fares."

Broadcasting Plays.

Mr. Powell was not enthusiastic when I asked him whether he liked to listen-in.

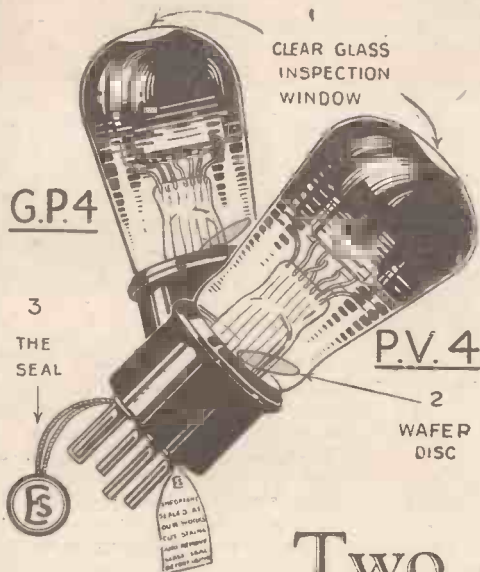
"Frankly, I do not," he said smilingly. "I could never forgive myself for daring to listen to Kreisler without watching every movement of his wonderful playing and drinking in the magnetism of his marvellous personality."

"All great artistes control not only their playing and their voices, but also their audiences, and the impressive sight of a spellbound audience of a few thousand not daring to move lest they miss anything in the masterly rendering of some great work by a famous artiste is a thrill that the ether will never manage to convey

into the intimacy of one's own home. Also I cannot rid my mind of the thought that reception is never perfect, and that there is always a certain distortion. Nor can I understand the broadcasting of excerpts of plays. All the acting is missing, and it is like having a play read to one."

In conclusion, Mr. Lionel Powell expressed the opinion that from their point of view, as concert managers, broadcasting does more harm than good.

"It is bringing the theatre to the public, when it is a case where the public should really go to the theatre. If I heard an announcement that the B.B.C. were going to broadcast the sound of the sea and all the joys of the seaside, I would prefer to be on the spot!"



Two New Valves

WHICH ESTABLISH A NEW STANDARD OF EFFICIENCY

EDISWAN—originators of the radio valve—now take reception a definite step forward. Here are two new DULL EMITTER valves—G.P.4 and P.V.4, with characteristics so decidedly superior that a new standard of valve efficiency is established.

You will identify G.P.4 and P.V.4 by these special features: (1) The Clear Glass Inspection Window; (2) The Wafer Disc; and (3) The Seal.

For detailed description and full specification obtain from your Dealer the Edison Folder—"Two New Valves."

G.P.4.—General Purpose dull emitter. Low current consumption. Long Life. Powerful amplification. Elimination of objectionable microphonic effects.

P.V.4.—Ideal power valve, companion to G.P.4. When used for Loud Speaker work: powerful, distortionless amplification. No microphonic effects.

*Both valves work off 4-volt accumulator

EDISWAN VALVES

Will improve any set

THE EDISON SWAN ELECTRIC CO. LTD
123-5, Queen Victoria Street, LONDON, E.C.4

N.V.1

To Purchasers of Radio Sets: You require FAITHFUL REPRODUCTION

Therefore, when you
order your Set
SPECIFY

FERRANTI

L.F.

TRANSFORMERS

Type AF4 : : 17/6

Type AF3 : : 25/-

The "Nearly Perfect" Transformer.

Ask for Leaflets Wa401 and Wa402.

FERRANTI, LTD., HOLLINWOOD, LANCASHIRE



...lower H.F.
resistance than
any other commercial plug in
coil!

Made by the
manufacturers
of Glazite.



TESTS carried out by the National Physical Laboratory show that the LEWCOS COIL has a lower H.F. Resistance than any other coil on the market. Its low H.F. resistance combined with great selectivity and mechanical strength make the LEWCOS Coil the finest you can buy.

Try a LEWCOS Coil in your set—it makes all

the difference! Descriptive leaflet sent free on request to:

THE
LONDON ELECTRIC WIRE
COMPANY & SMITHS LTD.
Playhouse Yard, Golden Lane,
London, E.C.1.

No.	25	35	40	50	60	75	100	150	200	250	300
Price	4/6	4/6	4/6	5/-	5/6	5/6	6/9	7/6	8/6	9/-	10/-

LEWCOS Inductance COIL

JUDD



Traders and manufacturers are invited to submit wireless sets and components to the "P.W." Technical Dept. for test. All tests are carried out with strict impartiality in the "P.W." Test Room under the supervision of the Technical Editor, and the general reader is asked to note that this weekly article is also intended to provide a reliable and unbiased guide as to what to buy and what to avoid.—EDITOR.

RUSSELL'S HERTZITE CRYSTAL.

WE recently received samples of two grades of Russell's Hertzite from Leslie G. Russell of 1 to 5, Hill Street, Birmingham. Hertzite is a well-tried synthetic crystal and has given consistent satisfaction to thousands of listeners. It was introduced many years ago and despite the subsequent introduction of numerous rivals is still able to hold its own.

Russell's Hertzite is very good and on test both grades gave excellent results. Aurally there was not much to choose between them, but the "purple label" specimen gave slightly higher micro-ammeter readings. Reception was loud and clear and adjustments were stable. The crystals were found to be equally sensitive over their whole surface. Gold, silver and brass cat-whiskers could be used with more or less equal results.

In a reflex receiver the crystals proved

exceptionally stable and retained their sensitivity after being subjected to heavy inputs.

M.H. BALANCING CONDENSER.

There are other circuits in addition to the ubiquitous neutrodynes in which some form or other of fine capacity adjustment of a more or less permanent nature is required, so that the new M.H. Balancing Condenser should command a ready sale. It is a product of L. McMichael, Ltd., of Wexham Road, Slough, Bucks, and is a well-made, reasonably-priced little component.

It is designed for either single-hole panel or baseboard mounting and is provided with a beautifully-cut thread of such a nature that, although the adjustment is smooth and precise, the knob does not have to be rotated hundreds of times before the range max.-min. can be covered.

Other refinements are visible calibration

marks and an indication arrow engraved on the top of the knob. Large soldering tags are provided and the construction and finish of the component is first-class throughout. The price of the M.H. Balancing Condenser is 4s. 9d.

CARBON ROD CONNECTORS.

A few weeks ago we referred to the H.R.P. Co's jars for wet H.T. battery units in these columns and since then we have received samples of zincs and connectors suitable for use with these from C. Vincent, of 147, Barclay Road, Walthamstow, E.17. The connectors consist of metal spirals which tightly fit on to the small carbon rods and make excellent contacts without the necessity of soldering. They are available at 1s. per dozen.

IMPORTANT PRICE REDUCTIONS.

Messrs. H. Clarke & Co. (Manchester), Ltd., Atlas Works, Old Trafford, Manchester, inform us that they have recently reduced the prices of a number of their famous "Atlas" components. Those affected are coils, fixed condensers, and fixed grid leaks and condensers combined. "Atlas" coils are now obtainable at such prices as 2s. 6d. for the No. 50, 3s. 6d. for the 150, and 4s. 6d. for the 300, and are, therefore, even better value for money than previously.

Messrs. Clarke also sent us folders concerning their D.C. and A.C. H.T. battery eliminators, and readers desirous of receiving copies of these and of the leaflets detailing the above price reductions are invited to write to the above address for them.



Another SHORTPATH Valve S.P. 18/B (BLUE SPOT)

This new S.P. 18 Valve supplements the well-known S.P. 18 Red Spot and Green Spot Valves. It is designed especially for use in resistance-capacity coupled sets and for use as a Detector and in H.F. neutrodyne tuned anode stages using 80-120 Volts H.T., so that where this H.T. is employed in the last stage, the difficulty of two H.T. supplies is avoided.

In addition, it gives still more amplification and consumes very little H.T. current.

The S.P./B (Blue Spot) is an excellent valve for anode bend detection.

Designed to work in parallel with the S.P. 18 Red Spot and Green Spot Valves, it operates from a 2-volt accumulator and consumes only 0.09 amp. filament current.

PRICES OF "COSMOS" SHORTPATH S.P. 18 VALVES.

RED SPOT	:	GREEN SPOT	:	BLUE SPOT
12/6	:	12/6	:	12/6

METRO-VICK SUPPLIES, LTD.

(Proprietors: Metropolitan-Vickers Electrical Co., Ltd.)
METRO-VICK HOUSE, 145, Charing Cross Road, LONDON, W.C.2

"Cosmos" SHORTPATH S.P. 18 Valves are recommended for use as shown below with alternative H.T. values:

Stage	Coupling	Recommended Valves H.T. 20-80 V. 80-120 V.	
H.F. Amplifier	Tuned Anode (neutrodyne) Tuned Anode (not neutrodyne) Transformer (loose coupled) Transformer (tight coupled)	Green Green Red Green	Blue — — —
Dual or Reflex Detector (Grid Leak)	All Couplings Resistance Coupling L.F. Transformer or Choke	Red — Green	Red Blue Blue
Detector (Anode Bend)	All Couplings	—	Blue
L.F. Stages	Resistance L.F. Transformer or Choke	Green Green	Blue Green
Last Stage	All Couplings	Red	Red

Cosmos

RADIO VALVES

R V39

Simple, accurate, and easily adjusted

**Moving
Block
cannot
fall :**

Don't experiment! Get a "Lotus" and be certain of better results. The vernier movement comprises three sets of enclosed precision machine cut gears and reduces the speed of the moving coil block by eight times. The moving block moves in the same direction as the knob, which prevents confusion. It also becomes absolutely rigid in any position, holding the heaviest coil securely. No screws required to tighten it.

LOTUS VERNIER COIL HOLDERS

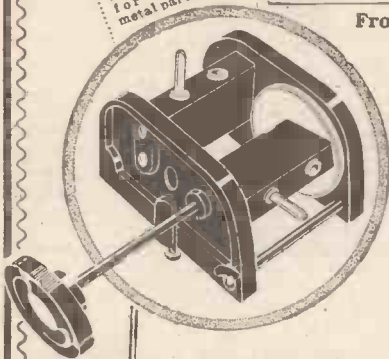
From all Radio Dealers.

Two Types :

For outside panel mounting
Two-way 7/-
Three-way 10/6
For inside baseboard mounting, with 6 in. handle:
Two-way 8/-
Three-way 12/6

**Garnett, Whiteley
& Co., Ltd.,**

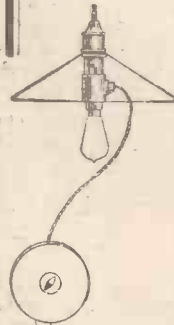
**Lotus Works, Broad-
green Road, Liverpool**
Makers of the new improved
"LOTUS" Valve Holder.



Bakelite
mouldings
for the side
plates, coil
blocks and
knobs. The
heavy nickel
plating for the
metal parts

HOME ACCUMULATOR CHARGING DEVICES

**No Technical Knowledge or Attention Required.
CLEAN, ECONOMICAL and CONVENIENT.**



"INDISPENSO" CHARGING SET (Direct Current). As illustrated.

Complete with cords and polarity indicator. For High Tension Accumulators. Plug-in to any convenient lampholder. Costs nothing for charging if light is in use. Complete with instructions. Price 6/-.

"ALTERNO" CHARGING SET (Alternating Current).

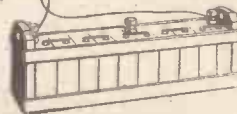
Charges your High Tension Accumulator at negligible cost. Plug-in to any convenient lampholder. Complete with instructions. Price 21/-.

"PENDELTON" CHARGER (Patent App.). (Alternating Current).

Charges your Low Tension, 2, 4 or 6 volts Accumulator economically and effectively. No Valves or replacements. Simply connect to the most convenient lampholder; charging rate about 2 amp. Price £2: 12: 6

Send for Catalogue and full details.

Write for name of nearest stockist.



Ward & Goldstone
PENDLETON. MANCHESTER LTD.

To get pure EBONITE, ask for



REGISTERED TRADE MARK.

**QUALITY
EBONITE**

RODS, TUBES, SHEETS, PANELS, MOULDINGS

Ask your dealer for "BECOL"

THE BRITISH EBONITE CO., Ltd., HANWELL, LONDON, W.7.

It is made from finest rubber and sulphur and is guaranteed free from surface leakage.

It proves its quality in every test. Its polish will also please you—ask to see it.

For either dull or bright emitters!

This "Peerless" Dual Rheostat covers the needs of both bright and dull emitter valves. It has two windings, one of a resistance of 6 ohms, and a continuation of this on to a 30 ohm winding. The resistance wire is wound on a hard fibre strip under great tension and is immune from damage. The popular one-hole-fixing method is provided, and the terminals are conveniently placed. The contact arm has a perfectly smooth silky action. All the metal parts are nickel-plated. Complete with ebonite combined knob and dial.



THE
"PEERLESS"
DUAL
RHEOSTAT

3/9

From any dealer or direct.

THE
**BEDFORD ELECTRICAL
& RADIO CO., LTD.,**
22, Campbell Road, Bedford.

Dealers are requested to write for trade terms.

CRICKET!

**All about the TEST Matches
and County Games**

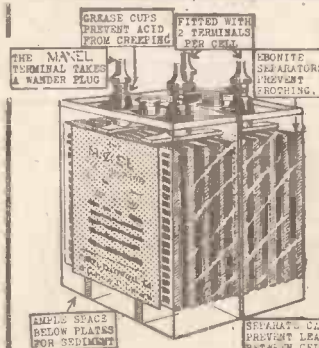
Every week ALL SPORTS contains many pages of exclusive Cricket Articles, Criticisms, and Chat. You can read the latest facts about the Australians and all the County Teams and Games. Buy a Copy To-day!



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The New **MAXEL**
Accumulator
GUARANTEED 12 MONTHS.

		AMPERES (Intermittent)			
		44	66	88	110
2-volt	8/-	10/-	12/-	15/-	
4-volt	16/-	20/-	24/-	30/-	
6-volt	24/-	30/-	36/-	45/-	

Now Packed Free. Corr. Paid.
Increased Trade Discounts.

H.T. 60 volts, 7/6 post free.

MAXEL BATTERY CHARGER
From Your Electric Mains.
THE LAST WORD IN
SIMPLICITY AND 27/6
EFFICIENCY. Post Free
Fully guaranteed. With instructions.

Telephone: MUSEUM 0708.
MAXEL ELECTRICAL CO.,

2, Maxel House, 28, Clapstone
Street, Gt. Portland Street, W.1

RADIOTORIAL

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The Editor will be pleased to consider articles and photographs dealing with all subjects appertaining to wireless work. The Editor cannot accept responsibility for manuscripts and photos. Every care will be taken to return MSS. not accepted for publication. A stamped and addressed envelope must be sent with every article. All inquiries concerning advertising rates, etc., to be addressed to the Sole Agents, Messrs. John H. Lile, Ltd., 4, Ludgate Circus, London, E.C.4. As much of the information given in the columns of this paper concerns the most recent developments in the Radio world, some of the arrangements and specialities described may be the subject of Letters Patent, and the amateur and the trader should be well advised to obtain permission of the patentees to use the patents before doing so.

Readers' letters dealing with patent questions, if sent to the Editor, will be forwarded to our own patent advisers, where every facility and help will be afforded to readers. The envelope should be clearly marked "Patent Advice."

TECHNICAL QUERIES.

Letters should be addressed to: Technical Query Dept., "Popular Wireless," The Fleetway House, Farringdon Street, London, E.C.4.

They should be written on one side of the paper only, and MUST be accompanied by a stamped addressed envelope.

Queries should be asked in the form of the numbered questions: (1), (2), (3), etc., but may be accompanied by a short letter giving any necessary additional particulars as briefly as possible.

For every question asked a fee of 6d. should be enclosed. A copy of the numbered questions should be kept, so that the replies may be given under the numbers. (It is not possible to reproduce the question in the answer.)

BLUE PRINTS. A series of 20 Blue Prints can be obtained from the Query Dept., price 6d. per Blue Print.

Only a limited number of circuits are covered by this series, and full details of the circuit arrangements available in Blue-Print form are published fortnightly in the advertisement columns of this journal.

All other back-of-panel wiring diagrams are specially drawn up to suit the requirements of individual readers, at the following rates: Crystal Sets, 6d. One-Valve Sets, 6d. One-Valve and Crystal (Reflex), 1s. Two-Valve and Crystal (Reflex), 1s. Three-Valve Sets, 1s. Three-Valve and Crystal Reflex, 1s. 6d. Four-Valve Sets, 1s. 6d. Multi-Valve Sets (straight circuits), 1s. 6d. Except SUPER-HETERODYNE DIAGRAMS, all of which, irrespective of number of Valves used, are 2s. 6d.

If a panel lay-out or list of point-to-point connections is required, an additional fee of 1s. must be enclosed.

Wiring diagrams of commercial apparatus, such as sets of any particular manufacture, etc., cannot be supplied. (Such particulars can only be obtained from the makers.)

Readers may submit their own diagrams, etc., for correction or for criticism. The fee is 1s. per diagram, and these should be large, and as clear as possible.

No questions can be answered by 'phone.

Remittances should be in the form of Postal Orders

Questions and Answers

NATURAL WAVE-LENGTH OF AN AERIAL.

L. T. (Yorks).—What is meant by the natural wave-length of an aerial, and what is the wave-length of an aerial conforming to the full limits of the P.M.G.'s regulations?

The natural wave-length of an aerial is the wave-length when the aerial is connected direct to earth without any coils or condensers in series with it. The natural wave-length of a normal P.M.G.'s aerial is generally accepted as being about 130 metres.

ELECTROLYTE FOR ACCUMULATORS.

R. P. (Carlton Colville).—What proportions of acid and water should I use to make the electrolyte for my new accumulator, and how should I mix the solution?

You will require one part of concentrated pure sulphuric acid to three or three and a half parts of distilled water. This will make up a solution of about 1.22 specific gravity.

The acid should be slowly added to the water (and not the water to the acid), and the solution left until it is cold.

Always use a glass or glazed earthenware pot with open top for the mixing receptacle, and if possible

conduct the operation in the open air, as fumes are given off during the mixing.

We would advise you, if you have a garage or chemist in the vicinity who supply acid already "broken" for accumulators, to avail yourself of their services, as this will save you a messy job, and one which may result in burnt clothes (due to the acid splashing).

GAS-PIPE "EARTHS."

P. S. (Southport).—Why is it not advisable to employ a gas-pipe as an earth connection? (I use an outdoor aerial.)

Apart from the fact that a gas-pipe makes a poor earth-connection—due to the material used in making the joints being a poor conductor of electricity—there is always the risk that in the event of the aerial becoming charged by electricity, it might be fractured and the gas ignited.

Even with an indoor aerial an earth-pin would be the better conductor, and providing the lead to it would not exceed 30 feet in length, we advise you to use this in preference to the gas-pipe.

WAVE-LENGTH AND FREQUENCY.

P. T. E. (Sheffield).—Is it correct that the oscillating current which flows in a receiving aerial changes its direction (i.e., alternates) at the rate of one million times in every second?

Yes, if the wave-length of the station transmitting is 300 metres (Sheffield is 301 metres), the frequency in the aerial will be 1,000,000 per second.

For longer wave-lengths the frequency will be lower, but for shorter wave-lengths it will be even greater than a million.

(Continued on next page.)

Stop that continued vibration of the filament!

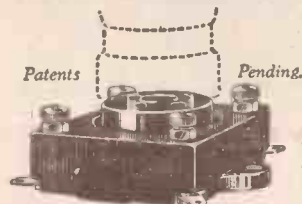
USE the Clearer Tone Valve Holder and *float* your valves—secure from the ever-present, tone - destroying vibrations caused by street traffic, indoor footsteps and the hundred and one other microphonic disturbances. So thoroughly does this new holder cushion the valve that foreign noises are completely dissipated.

The springs, though delicately adjusted, are immensely strong and the tightest valve can be inserted without fear of damaging them. Each spring has one turn only. Bakelite construction of the body of the holder ensures high insulation, low capacity and sturdiness.

each **2/9**



2/9
each.



BRITISH BENJAMIN MADE
CLEARER TONE VALVE HOLDER
(ANTI-MICROPHONIC)

From your Dealer or Direct from
THE BENJAMIN ELECTRIC Ltd.,
Brantwood Works, Tariff Road,
Tottenham, N.17.

The Benjamin Battery Switch gives
perfect current control, 2/- each.

RADIOTORIAL QUESTIONS & ANSWERS.

(Continued from previous page.)

The speed of all wireless waves is uniform (300,000,000 per second), and the frequency is easily found by dividing this number by the wave-length (in metres).

For instance, if the wave-length is 500 metres, the frequency is $\frac{300,000,000}{500} = 600,000$, per second. Similarly, if the wave-length is as low as 50 metres (and plenty of amateur transmitters use lower than this for experimental telephony) the frequency is $\frac{300,000,000}{50} = 6,000,000$ per second.

The wide divergence between wireless currents, and those of the ordinary house-lighting type, is clearly shown by the fact that the ordinary A.C. has a frequency of about 50 per second, whilst the short-wave wireless frequency given above is six millions per second!

DRY-CELLS.

L. F. (Chingford).—What is a dry-cell made of, and why can they never be re-charged?

The positive element of a dry-cell is carbon, which is surrounded by a paste containing manganese dioxide and crushed carbon arranged in a muslin wrapper. These in turn are surrounded by a highly

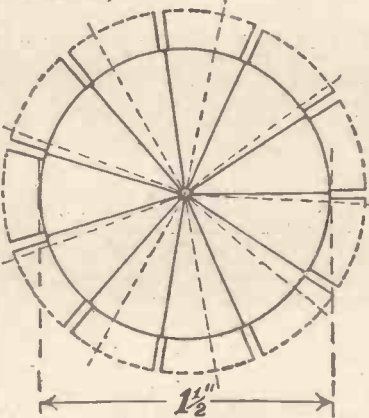
For the Constructor

NO. 4—TEMPLATE FOR SPIDER-WEB COILS.

Spider-web coil formers having a centre diameter of $1\frac{1}{2}$ inches can be made from this sketch.

The heavy lines show how eleven segments should be marked out, and how the slots are cut down towards the centre. The dotted lines show the arrangement for nine slots.

(Note:—The angles are the same for Basket coils.)



saturated solution of sal-ammoniac "bound" with a little glycerine, and whole is fitted with a zinc container, which forms the negative element.

When the paste surrounding the carbon dries, the cells become useless, and they are not worth re-winding because of the comparatively low initial cost.

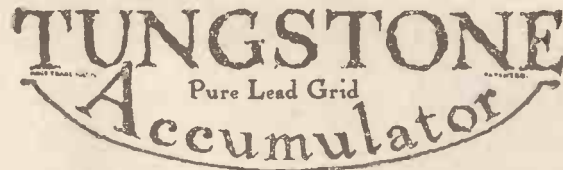
POLARITY OF D.C. MAINS.

L. M. (Southend).—Please inform me of a reliable method of finding the polarity of my D.C. mains, as I wish to use them for my H.T. unit and also for charging accumulators.

There are several good methods of finding the polarity of D.C. mains, the water test being perhaps the best and simplest. This consists of inserting the two leads from the mains in a cup of water. If the two wires are kept well apart in the water bubbles of gas will be given off the negative pole in a greater quantity than at the positive. This gas will be hydrogen, and may be tested by holding a lighted match just above the water at the point where the gas is coming off, when each bubble should ignite.

Another well-known test is to rest the leads on a freshly-cut surface of a potato. The positive lead in this case leaves a greenish blue mark. Polarity can also be found by means of paper impregnated with potassium iodide and starch. If the paper is moistened and the wires held in contact with it about an inch apart the positive will leave a brown stain.

Tungstone uses ONLY PURE LEAD for GRID and PASTE with Plates high-pressure Die-cast and Pasted entirely by Machinery, is the Secret of the Success of Tungstone High or Low Tension Batteries. Tungstone (patented) British Made Batteries are practically Foolproof.



Entirely of British Origin and Workmanship.

Wireless Weekly, February 24th, 1926. By PERCY W. HARRIS, M.I.R.E.

Congratulations to the makers of the Tungstone high-tension accumulator for producing a really practical job. I have had one of these batteries in continuous use for some little time, and have learned to appreciate the eminently practical form of its make-up. It stands a far higher charging rate than is usual for such an accumulator its cells are robust and of adequate size, and I greatly appreciate the ability not only to tap off at every two volts, but to pick the voltage I want without having to count up the holes, as is generally the case with high-tension accumulators.

This is made possible by the insulating sheet which covers the top of the cells and has marked on it the various voltages available. The holes in the sheet come just above the tappings, so that while the tapping holes are accessible for the wander plug, the cells themselves are protected from dust (which can easily set up annoying leakages). I also appreciate the small lead funnel and adequate holes for filling. The only criticism I would make is that, owing to the placing of the individual cells, it is very difficult to see when one has poured in enough acid. In spite of rather heavy drains upon it and long periods of inactivity, the battery is holding its charge well.

CHARGING HIGH-TENSION AT 12-16 VOLTS POTENTIAL.

All H.T. Tungstone Accumulators are made of Pure Lead without Wood Separators and fitted with a Patent Equipment whereby each series of 12 Volts are coupled in parallel so that these H.T. Batteries of whatever voltage can be charged at local Garages and Charging Stations on a 12-16 Volt Low Tension Charging Plant at the low cost of 2/- for each charge.

Charging Terminals are provided on the front of the Cabinet arranged in two rows, the top row being Positive and the bottom row Negative. When in use these charging terminals are connected in pairs so that all cells are in series.

TUNGSTONE High Tension 60 Volt Battery 3 a.h. is sold in the United Kingdom on monthly payments over extended period. Apply for particulars. Further interesting information on points of this advertisement are to be found on pages 58, 59, and 67 to 73 of the Illustrated Booklet "Photography tells the Story" which will be sent free on application to the—
TUNGSTONE ACCUMULATOR CO., LTD., St. Bride's House, Salisbury Square, London, E.C.4.

HEADPHONES REPAIRED

Re-wound & re-magnetised 5/- per pair. Loud Speakers repaired 5/-. Transformers re-wound 5/- each. All work guaranteed and tested before delivery.

Write for Trade Prices. Phone: Clerk, 1795
MASON & CO., 44, East Road, City Road, N.1.

PICKETTS CABINETS

:: For every Wireless Constructor ::
Send for Cabinet Designs and Lists Free
CABINET WORKS, BEXLEYHEATH (nr. London)

THE STARS OF VALVE ECONOMY

Great Selectivity Distortionless Amplification Loud Speaker Volume

9* 9* 11*

2Y .06 HF 2Y .06 LF 2Y .34 PV

Obtainable from Lewis's, Ltd., Liverpool and Manchester, and LUSTROLUX, LTD., West Bollington, Nr. Macclesfield.

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now and save many shillings by selecting your every radio need from our

"SUMMER CATALOGUE."

It contains a large and wonderful selection of Radio Bargains and nearly 600 of them are illustrated too.

Send 4d. stamps for a copy by return of post.

ELECTRADIX RADIOS,
218, Upper Thames St., London, E.C.4

Parrs Ad.

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in Coils, Rheostats, H.T. Batteries & Grid Leaks

Ask your dealer by Brand Name.

ANODON LIMITED

72-86, Oxford Street, London, W.1

WET H.T. BATTERIES.

British-made Glass Jars, 2 1/2 by 1 1/2, for making up wet H.T. units (Leclanché), 1 1/2 doz., or waxed to prevent creep, 1/3 doz. Post extra. Phones rewound and remagnetised, 4/6 per pair. The H.R.P. Co., 46, St. Mary's Road, Leighton, L.1

06 DE'S 10/6

Our Valves are admitted to be the best British made valves on the market. 3 Volt 06 L.F. or H.F. only 10/6 2 Volt '34 only 10/6. Power Valves from 12/6. Write at once for our FREE BOOK and get full particulars. If your dealer is "tied" we supply direct. RADIONS LTD. Radion Works, BOLLINGTON, Macclesfield, England



REPAIRS SETS, PHONES TRANSFORMERS

Officially Approved by Radio Association. ALL WORK GUARANTEED LOWEST RATES 24 HOUR SERVICE Cash on Delivery if Desired. JOHN W. MILLER, 68, Farringdon St., E.C.4. Phone: Central 1950

THE BAWTREE H.T. ACCUMULATOR.

Price from Sevenpence per volt.

The most handsome on the market, an ornament to any set. Screw terminals and engraved numerals every 2 volts. French-polished case. Particulars post free from A. E. BAWTREE, 20, Manor Park Rd., Sutton, Surrey.

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Correspondence

Letters from readers discussing interesting and topical wireless events or recording unusual experiences are always welcomed, but it must be clearly understood that the publication of such does in no way indicate that we associate ourselves with the views expressed by our correspondents, and we cannot accept any responsibility for information given.—Editor.

A STRAIGHT THREE-VALVER.

The Editor, POPULAR WIRELESS.

Dear Sir,—With reference to my recent letter giving results obtained from my straight 3-valver, I have been inundated with requests from readers

visiting this country, and has trained his sister to operate his station during his absence, thus keeping him in constant touch with home conditions. The writer has had the pleasure of exchanging tests signals with Miss Bell during the past week, and can testify to the skill with which she manipulates both transmitter and receiver. This must surely be unique in the history of amateur radio.

G 2 O D is at present carrying out a series of special tests with Australia and New Zealand, using a wave-length of 32.1 metres.

As far as possible, glass has been used as an insulator throughout this transmitter, all chokes, etc., being wound on good quality glass tubes, and glass supports being used on all inductances, condensers, etc.

An entirely new radiating system has been designed to eliminate as far as possible the useless ground wave, and an endeavour has been made in this scheme to project much of the radiated energy at an upward angle and thus obtain the most favourable reflection from the Heaviside layer.

As these special tests

have only been in operation for the past fortnight, it is too early to give detailed results, but one report is of interest.

Working with Australian 2 L M during last week, he was able to read the telegraphic signals from this set 50 feet from a loud speaker, using a receiver of one detector and two low-frequency stages.

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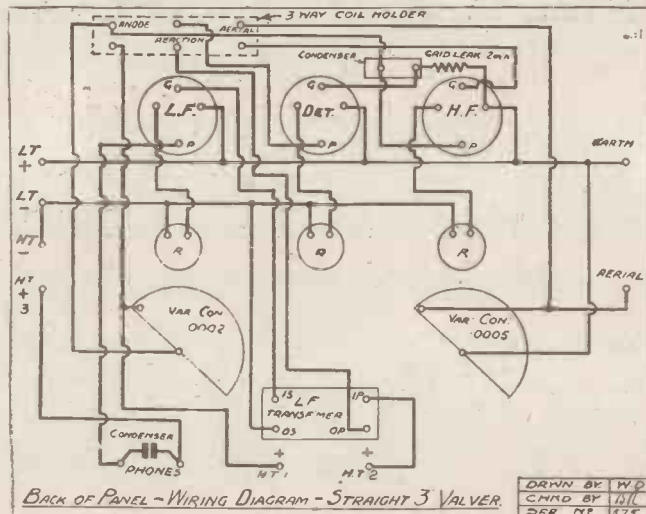
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asking for particulars, and I find it impossible to reply in detail to all of them individually.

I should be grateful, therefore, if you could find space to publish the enclosed "back-of-panel" wiring diagram, which I think is self-explanatory.

Using 2-volt D.E. valves, which I find the most reliable type, although any type almost will do, best results are obtained from the three H.T. leads as follows: H.T.+1, 15 volts; H.T.+2, about 36; H.T.+3, about 45, but best values of H.T. are, of course, only found by experiment, and these have a large bearing on results.

If the H.T.+1 wander-plug is taken from H.T. battery, and plugged into grid socket of H.F. valve, we get a rather interesting circuit. I can work my L.S. from 2 L.O. or Bourne-mouth with it, quite easily. (Of course, the valve has to be taken off!) Since I last wrote I have logged, in addition, Barcelona (325 m.), Voxhaus, Hanover, the two new Cadiz stations, Bilbao, Zurich, Geneva, and, I think, Moscow.

Yours faithfully,

B. M. FARRAR.

SHORT-WAVE JOTTINGS.

THE present period is a very good one for the long distance reception of signals on wave-lengths around 35 metres, and between 05.00 and 07.00 G.M.T. daily, large numbers of New Zealand and Australian stations can be received at excellent strength on this wave-band. The signals from New Zealand 4 A A are coming in very well, and are of particular interest to us at the moment.

It will be remembered that Mr. Bell (the operator and owner of 4 A A) was the first New Zealand amateur to hear short-wave signals from this country. This took place in October, 1924, when he heard and verified 95 metre signals transmitted from the writer's station, thus marking an event of greatest importance in the development of short-wave technique. Mr. Bell is at present

PLAYER'S MEDIUM NAVY CUT CIGARETTES WITH OR WITHOUT CORK TIPS

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P 1323

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Is so economical that no sign of glow can be discerned.

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R.R.

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OSCILLATION AND THE B.B.C.: THE REMEDY.

Popular Wireless

Every Thursday
PRICE
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No. 212. Vol. IX.

and Wireless Review
Scientific Adviser: SIR OLIVER LODGE, F.R.S., D.Sc.

June 26th, 1926.

Special Features.

Radio in Summertime.

How to Use Valve
Curves.

A "P.W."
Ultra Crystal Set.

Loud-speaker
Extensions.

The Prince and
Broadcasting.

Our cover photograph this week shows the engineers of the American broadcasting station W G B S listening to a concert transmitted from a large passenger aeroplane.



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Another great contribution to the Science of Radio by Cossor

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For H.F. use.

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15/6

For 2-volt
Accumulators.

The new Cossor Point One

—the '1 amp. Valve which
utilises Co-axial Mounting

**Cossor
Stentor Two**
Power Valve
Consumption '15 amp

18/6

For 2-volt
Accumulators.

IT was a flash of genius that enabled Simpson eighty years ago to discover chloroform. Genius, too, helped James Watt to read the lesson of the steam engine in the escaping steam from his mother's kettle. Assuredly it was genius that caused Montgolfier to visualise in the floating remnants of a burning paper bag the world's first balloon—the prelude to man's conquest of the air.

And once again a touch of genius has been responsible for an entirely new method of valve construction that bids fair to produce results which, but a year ago, would have been considered impossible.

The new series of Cossor valves employ—for the first time in the history of Radio—a method which, accurately and for all time, ensures perfect alignment for the filament, grid and anode. At the same time it provides a shockproof support for the filament.

Thus throughout the whole life of the valve its working characteristics cannot alter. Age cannot cause filament sag nor can hard wear disturb the exact relative positions of the filament, grid or the anode.

But this is not all. The improved Cossor filament consumes but a modest part of the current required by other Dull Emitters—its consumption at 1.5 volts being barely one-tenth of an ampere. A seven-valve Super Heterodyne, for example, using these new Cossor Point One Valves would not con-

sume as much current as a little one-valve set using a single bright emitter.

As can be imagined, the filament used in this new Cossor is no ordinary filament. Owing to its exceptional length and its scientific method of preparation a great latitude in working voltages is permitted. Satisfactory results are obtainable at a voltage as low as 1.2, so that the valve can, if required, be used with dry cells. Further, its operating temperature is lower than that of any other valve on the market. And everyone knows that low temperature means long life.

The Cossor system of Co-axial Mounting has now finally abolished the last bug-bear of dull emitter valves—microphonic noises. Individual movement of either the grid or the anode in the Cossor Point One is utterly impossible. The scionite insulator holds them both in a vice-like grip which defies the hardest shock.

With its handsome pipless glass bulb, its re-designed low loss moulded base, and its new positive contact pins the introduction of these new valves represents one of the most important events in the progress of the Valve. See your Dealer about them to-day—we can promise you new delights in radio reception. A greater economy, improved sensitivity, a wonderful richness of tone, with a length of life and uniformity of performance which will positively astonish you.

Cossor Valves

—The new Dull Emitters with the long-life '1 amp. filament.

Popular Wireless

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RADIO NOTES AND NEWS.

New Station at Daventry—B.B.C. and Parliament—Prince to Broadcast—House Saved by Aerial—Regular Westminster Abbey Broadcasts—Cheaper Components Coming?

New Station at Daventry.

QUITE the most interesting announcement which the B.B.C. has issued recently is that relating to the new experimental station at Daventry. It foreshadows the day when we shall have fewer stations on higher power, and when every set in the country will be provided with alternative programmes.

As most readers will remember, the B.B.C.'s idea is that the broadcasting service can be improved, and interference can be reduced, by a reorganisation of the British transmitting stations. The new Daventry testing station is a step in this direction.

Super-Station is an Extra Turn.

WHAT ever you do, don't run away with the idea that 5XX is to be interfered with. The new Daventry station is to be absolutely independent of the old one, which will carry on "as per." But the new experimental station will test outside broadcasting hours, in the mornings, and late at night.

It will work right on the normal broadcasting wave-band (probably between 300 and 500 metres), and the power output will be decidedly hefty. Ten kilowatts will be employed at first, and this may be doubled as time goes on, enabling the station to be picked up all over the country. No call sign has been fixed at the time of writing, but readers who are old hands will remember that the last station of this kind, operating at Chelmsford, was called 5GB.

Radiola on the Sick List.

IT takes a lot to upset the Radio-Paris station in the ordinary way, but the other evening it was off the air altogether. The reason for this was the thundery weather in France, during which this famous broadcasting station—formerly known as "Radiola"—was struck by lightning.

Nobody was injured, or anything of that kind, but it was impossible to give the usual evening concert until the engineers had straightened things out again.

B.B.C. and Parliament.

I HEAR that the Postmaster-General, and certain other ministers directly concerned in the framing of legislation for the future control of broadcasting, have been giving attention to the form which the new laws will take. A measure of some kind must be put through before the end of the year, for certain, but it is unlikely to be ready for debate in the House of Commons until the Autumn session.

Prince to Broadcast.

THE Albert Hall meeting arranged in connection with the National Savings

He has already prepared a talk upon the subject, and this will be broadcast separately beforehand, so that listeners will be able to follow the actual submergence, apart from what Mr. Shields has to say upon the subject of diving in general. The microphone is to be fitted into the helmet of the diving-suit.

Another "Village Concert."

A GREAT many London listeners will be glad to know that there is to be another performance of the Village Concert—this time from Daventry. The last one upon the lower wave-length was a great success, and many of us will tune up to 1,600 metres to hear it all over once more, on Tuesday, July 6th. The Vicar of Mirth will preside again, and the concert is timed to run from 8.45 to 9.30 p.m.

New Radio Revue.

ONCE again the Programme compilers are getting busy on bright and breezy stuff, and revues and variety turns are the order of the day. Next Saturday (June 26th) there is to be a fresh edition of our old friend, "Winners," with its music-hall melodies, and a week later there is to be a brand new radio revue. This is

announced to be a little bit "slicker" than its predecessors, and will be included in the London programme upon Saturday, July 3rd.

House Saved by Aerial.

A HOUSE in London Road, Coalville, was recently struck by lightning during a thunderstorm, and it is believed to have been saved by its wireless installation.

According to an eye-witness, the house appeared to be suddenly enveloped in a ball of fire. Nevertheless, only one chimney-pot was broken, in addition to the aerial,

(Continued on next page.)



OSCILLATION AND THE B.B.C.

Talk will not stop oscillation; a practical cure is needed. Below we publish a photo of a Lodge "N" receiver, which will not re-radiate, and which the B.B.C. should investigate. See the Editor's article "Current Topics" in this issue.

Movement has now been fixed to take place upon Friday, July 9th.

Owing to the strike it had to be postponed, but the proceedings are now timed to start at 7 p.m., and they will be broadcast from London and other stations. There will be some notable speeches upon this occasion, and listeners will once again have the pleasure of hearing the Prince of Wales.

Wet Wireless.

WHEN Mr. Frank Shield, the ex-naval diver, broadcasts from the bed of the Thames on Monday, July 5th, he will enter the water from the parapet of the County Hall, Westminster.

NOTES AND NEWS.

(Continued from previous page.)

which was completely destroyed. The aerial was connected direct to earth when the flash occurred.

Dot to Carry On

THE recent troublesome epidemic of breakdowns has raised again the question of emergency signals. It is often said that when a programme has to be interrupted, owing to a technical fault, some kind of signal should be provided to keep listeners in touch until the damage has been repaired. Dots, or call letters in Morse, or Morse figures, have all been suggested, but none of these arouse my enthusiasm.

Breakdowns are not very frequent, anyway, and when they come the engineers want to get busy repairing them, without having emergency gear to bother about. It's much easier to look for a fault when all the "juice" is off, and this alone is a serious drawback to the emergency-signal plan. Besides, most listeners know when the local station is transmitting—even if silent for a time it can be "felt" whilst the power is on.

Regular Westminster Abbey Broadcasts.

RECENTLY, I mentioned the fact that the B.B.C. was trying to arrange a regular religious service for the benefit of hospital patients, the infirm, and other "shut-ins," who owing to ill-health are obliged to spend secluded lives. Now, I am glad to be able to announce that the Dean and Chapter of Westminster Abbey have given permission for such a service to be broadcast from there. It will, of course, be quite distinct from the usual Sunday evening transmissions. The first service under the new scheme has been arranged to commence on Thursday, July 22nd, at three p.m.

Revising the British Stations.

ARISING out of the new Daventry transmitter—which will shortly be testing upon the ordinary low broadcasting wave-lengths—reports have already been going round about the closing of certain relay stations, and an increase of power at other centres. All this is beside the point at the moment, for the new plant at 5XX is purely experimental. It may be dismantled soon after erection, or it may not, but in either case it is quite certain that there will be no question of closing down any station, unless other and better facilities are provided for the listeners there. So if you are going to buy a set, don't hesitate to do so because of some fool-rumour going round—broadcasting is undoubtedly going to get better and louder as the days go by!

Shock for Schoolboy.

WHEN attempting to climb one of the stays which support the masts of the great Post Office super-radio station, a Rugby schoolboy received a severe shock and was very badly burned about the head and hands. It was, indeed, fortunate that he was not killed outright, for the wire that he touched was charged up to a potential of about 10,000 volts. Needless to say, he was trespassing on

forbidden ground at the time, but, as the station occupies an area of about 900 acres, he and his two companions escaped notice until the damage was done.

A Corking Idea.

INSTANCES of racing pigeons and other birds being injured—or even killed—by accidentally flying into aerial wires are still occurring far too frequently.

A Manchester official of the People's Dispensary for Sick Animals of the Poor said recently that it is no uncommon experience for fanciers to bring birds with broken legs or wings for treatment. When the birds are fairly on the wing, they fly far above the average aerial, but there is danger where they are rising or alighting, and corks placed at intervals along the wire are their only safeguard.

Sometimes fanciers bring the corks along and ask the aerial-owner to fit them to the wires. Such requests should be complied with, for reception is not impaired in any way. It's up to us all to prove that wireless is not the kind of hobby that takes toll of valuable lives and beautiful creatures, and I am sure that "P.W." readers will willingly assist local pigeon-owners in keeping the air safe for the birds.

The Mouth-Organ King.

LISTENERS who remember the broadcast from Daventry by the "Mouth-Organ King," will be sorry to know that he has since died in hospital, at the

SHORT WAVES.

"Too much listening-in is bad for anyone: they become melody-soused as the professional critics do. Yet in this way a musical public is being built up that otherwise would have taken generations to produce. Every man has a concert hall of his own at last."

Musical Standard.

"For all wireless sets let there be this golden rule—let there be a good aerial."

Capt. P. P. Eckerseley.

age of 53. In private life he was Mr. W. V. Robinson, son of an English bandmaster, and in his varied career he had figured as a grocer's assistant, a member of the North-West Mounted Police Force, a stockbroker, and the editor of a newspaper.

On the music halls he scored a great success, and Sir Harry Lauder engaged him as a member of his company during his last world tour. During the General Strike, Mr. Robinson left his sick-bed to broadcast from 5XX—it was his last appearance before the public.

Shakespeare's Heroines.

THE B.B.C. is doing its bit towards the Stratford-on-Avon Shakespeare Memorial Fund. Following the broadcast series of Shakespeare's Heroines, a booklet will be published shortly at two shillings net, and the whole of the profits will be devoted to the Memorial Theatre Fund.

Mr. Charles Ricketts, R.A., has generously consented to illustrate the work with a series of twelve original black and white drawings. The little volume will also contain a colour-plate and short descriptive articles by distinguished dramatic authorities.

Wireless for the Parks.

RECENT experiments in Temple Gardens have encouraged the London County Council in the belief that possibly wireless music may solve the problem of entertainment in the parks. Another trial is to be made—this time in Battersea Park—and there is a suggestion that in time it will not be necessary to rely upon the B.B.C. programmes. Instead, the music may be supplied by one central band, and then be relayed and reproduced to other parts of London. At the moment, however, the Chief Officer of the Parks Department is quoted as stating there is no question of replacing bands by broadcasting.

"On Trial."

ACCORDING to a Manchester evening paper, the Chairman of the Bolton Watch Committee stated that he did not think the wireless licence fee had been paid for the wireless receiving apparatus which had been installed temporarily during the General Strike.

"It is on trial," he said, and I don't think the fee is payable when the set is on trial."

If I were the Watch Committee I should watch out, or it may not be only the set which is "on trial"!

The Talk of the Clouds.

BY means of his wireless telephone transmitter, the leader of an Air Force unit can now swing his squadron about to his own will, so that nine machines can fight as one, and act tactically as a single unit. The perfection of radio control has recently been demonstrated at the Kenley Aerodrome, where No. 25 squadron, stationed at Hawkinge, and equipped with Grebe fighting scouts, has been rehearsing in connection with the Royal Air Force display.

This will be open to the public at Hendon on July 3rd, and it is expected to be the most thrilling air spectacle that has ever been staged in Britain.

Cheaper Components Coming?

SUMMER is usually the time when wireless manufacturers contrive to reduce prices, but so far I have not seen much sign of reduction this year. One notable exception is furnished by the Telephone Manufacturing Co., Ltd., of West Dulwich, who announce that the price of their No. 3 headphones (in plush-lined case) is now 19s. 6d. instead of 22s. 6d. Transformers, valves, and batteries are three of the things listeners would like to see cheapened, and the firms that drop first are the ones which will sell most.

Students Saved by Microphone.

EVERYONE knows how serious is the position of a student whose education is arrested by illness. His time-table gets out of gear, he gets behind with his lectures, and sometimes the work of years is frustrated by confinement to the house.

Radio is changing all that. At a sanatorium in Leysin (Canton of Vaud, Switzerland) university lectures are brought to the bedside of the invalids by wireless. The sanatorium caters specially for students undergoing medical treatment, and lectures are delivered by visiting professors, and broadcast to those unable to leave their bedrooms. About fifty students are now installed at this university sanatorium of Leysin.

ARIEL.



The Prince and Broadcasting

by Ariel



ON a lonely country road a handsome limousine is driving along at a steady but not precarious speed. Houses and telegraph poles flash by as, with dexterous turns of the wheel by the chauffeur, the car takes the turnings and lanes with almost ridiculous ease.

While the miles are being eaten up, a young man is sitting inside lighting a cigarette and blowing smoke-rings with evident enjoyment.

The Prince's Portable Set.

He is gazing out of the window at the changing landscape, at the cows grazing in the meadows, at the factories, the villages, and the thousand other sights the country offers.

Suddenly he picks up a neat brown attaché-case and places it on the seat facing him. He presses the catch that flings back the lock, slips open two more catches, and, before you have realised what has happened, the interior of the case is filled with the strains of music.

The Prince of Wales leans back and for the next hour or so enjoys a part of the programme from a London station of the B.B.C.

His Royal Highness is an ardent wireless enthusiast, and he follows with real interest its progress, both as a science and as a hobby.

The Prince, however, is not the only member of the Royal family who likes

The Prince of Wales has broadcast several times during the last two or three years and in this special article "Ariel" shows that the Prince is a keen amateur as well as a highly successful broadcaster.



H.R.H. The Prince of Wales speaking into a microphone at the Connaught Rooms.

wireless. The King often listens-in during the evening, while Prince Henry and the Duke of York (who has a fine set at his house in Bruton Street) while many an hour away listening to wireless programmes.

Whenever he has a chance, the Prince listens-in. A powerful valve set used to follow him wherever he went. Prince Henry has it now, however, and it is the means of filling in many a tedious moment at Aldershot.

A Little DX Work.

The Prince relies mainly on his portable set now. This follows him wherever he goes, and is often used in his car, in the train, and, in fact, wherever he stays.

The large set was in use either at the Prince's rooms at Melton Mowbray, where he goes for hunting, or at York House.

The Prince is remarkably adept at picking up stations. His friends, who have watched him listening-in at St. James' Palace, have often been interested at his knack of picking up distant stations.

With the headphones, he captures a carrier wave and settles down to "resolve it." There is rather a serious look on his face, which relaxes when he hears the faint signals, and then he is full of real radio enthusiasm.

"Got it!" he murmurs excitedly. "Madrid, and pretty loud, too!"

Then the Prince tries another station, and another, and another, until finally he

(Continued on next page.)



H.R.H. The Prince of Wales at an ambassadorial banquet. His speech on this occasion was broadcast from all stations. On the Prince's left is Mr. Winston Churchill.

THE PRINCE AND BROADCASTING.

(Continued from previous page.)

has got half-a-dozen right off the reel; and then he leans back with a sigh of satisfaction, lights a cigarette, and contents himself with the band from the London station.

The Prince is particularly proud of his portable set. It is a very neat arrangement in a brown leather case, with the aerial wound on a frame on the inside of the lid. It contains a nickel loud speaker and works on either two or three valves.

The millions of listeners who have heard the Prince broadcast have wondered if he enjoys broadcasting just as they do. The answer is decidedly in the affirmative.

There is an art in speaking perfectly before the microphone, and the Prince is one of the few masters who excels in broadcasting speeches. He speaks with confidence, and his voice carries well.

Surprise Visit to 2 L O.

It is a delight to hear him on the wireless. His very voice suggests the vitality and energy of youth, the courage of his convictions, and one feels the ardour with which he emphasises the passages in his speeches and lets his points get well home.

The Prince's interest in wireless, however, does not rest there. His interest in broadcasting can be described as very active.

One evening at the B.B.C., at Savoy Hill, about 5.30 p.m., when the full organisation was working at top speed, the Prince arrived on a surprise visit.

There were not many who recognised him as he

stepped out of his car and rapidly entered the London station.

He was met by Mr. Reith, the managing-director of the B.B.C.; Mr. Roger Eckersley, head of the programme department; Captain P. P. Eckersley, the chief engineer, and one or two other officials.

Working the "Effects."

Without any loss of time, the Prince commenced his tour of inspection of the London station. He was shown the different studios, and explained their allocation to various items in the programmes.

The Prince saw the small studios where pianoforte solos and singing items are broadcast; and the larger studios which hold the bands, revues, and concert-parties. He, however, took particular interest in the studio where are all the "effects." The Prince tried his hand at one or two, and seemed very amused by the simple contrivances which produce the sound of the sea, horse-hoofs, or thunder. The Prince then met some of the Uncles, and enjoyed a few minutes of the Children's Hour.

What interested the Prince most in the London station, however, was the control-room. He was shown over this part of the organisation by Captain Eckersley, the chief engineer. He put on the headphones and listened in to the different B.B.C. stations relaying their programmes.

In all, the Prince spent just under two hours at the London station, in the course of which short time he had learnt a good deal of the workings of the organisation from A to Z.

Speaking of the Prince's visit, Mr. Roger Eckersley told me:

"His visit left a big impression on us, and we were all very happy to discover that he was such an ardent radio enthusiast."

I am told that the Prince's favourite item in broadcast programmes is dance music. He has often danced to wireless music, but he also likes more serious music and enjoys the classics.



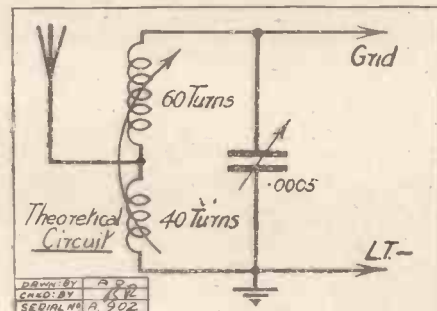
The Prince, on the occasion of his visit to Mill Hill School, examines Mr. Goyer's amateur transmitting station.

A SELECTIVE TUNING ARRANGEMENT

MANY listeners are subject to interference from spark or local broadcasting stations, and are unable with ordinary single circuit tuning to eliminate it to any extent. The arrangement shown in the diagram gave very good results when in use near the Thames estuary, where spark interference is very strong.

Referring to the diagram, it will be seen that two coils are used, of 40 and 60 turns respectively, with the two coils connected together and to aerial, the other end of the turns connected to the grid of the valve, and the remaining end of the 40 turns to L.T. negative and earth. The whole is tuned by a .0005 variable condenser, which should be provided with Vernier adjustment.

By varying the coupling between the coils, very fine tuning is obtained, while signal strength is not noticeably reduced. When first in use, the coils were mounted in a Vernier two-coil holder, but as it was desired to incorporate the tuner in the set,

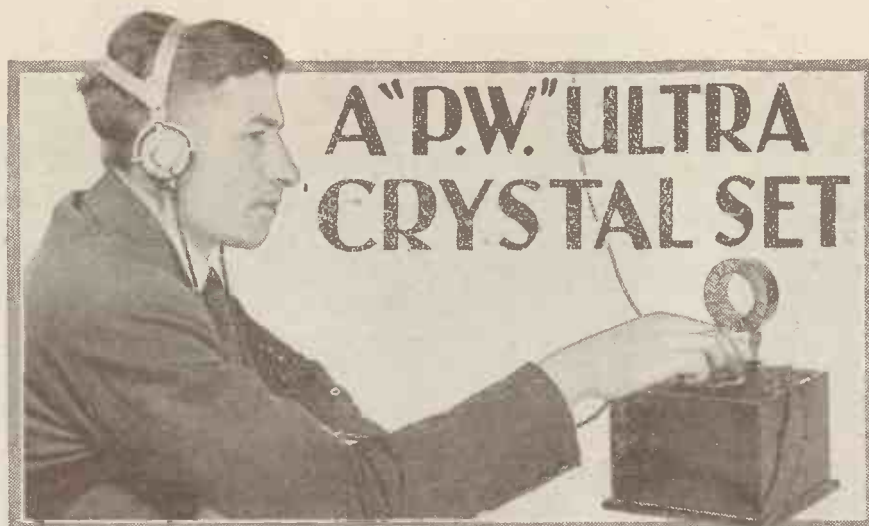


without altering the existing lay-out, a variometer was made in which the 40 turns became the rotor and the 60 turns the stator; the .0005 variable condenser was, of course, still used. In this form it gave very good results and well repaid the time and material used in making it. Should a two-coil holder be used, the wiring should be arranged so that the direction of the coils is the same.

Ultra Coil Experiments.

Experiments, however, led to the discovery that a fixed coil tapped at the fortieth turn and connected as before, gave less selectivity than a 60 turn "P.W." Ultra coil.

This tuner was originally used in an H.F., Det. and L.F. set using reaction on the anode coil of the H.F. valve. Reaction on the aerial was afterwards used with the coils mounted in a three-way coil holder. The fixed coil was of 60 turns, one of the moving holders carrying the 40-turn coil, the reaction coil, 75 or 100, occupying the other. Should the home constructor who is not troubled by interference have in his "junk box" the necessary parts, it would be worth hooking it up. Despite the increased selectivity obtained, this tuner is quite easy to handle, and considering the number of stations now operating between 250 and 500 metres, should certainly be given a trial when DX is attempted.



The Set Designed, Constructed and Described by the "P.W." Technical Staff.

NOW that 5 X X is transmitting a morning programme, it is a great advantage for those listeners who are situated within range of that station to be able to switch over to the long waves. At any point within 100 miles of the B.B.C.'s high-power station, quite good signals are receivable from Daventry upon 1,600 metres, provided, of course, that an ordinarily efficient outdoor aerial is employed.

Later in the day, when the local station is transmitting, in most districts these signals will be stronger than the Daventry ones. But, nevertheless, it is desirable to be able to change over to 1,600 metres, in order that the alternative programmes afforded by 5 X X are available, when the local station is closed down.

Few Parts Necessary.

For this reason there has recently been a great demand for an easily made, easily handled crystal receiver, which is capable of tuning both to the local station (low waves), and also up to 1,600 metres, for the reception of Daventry.

LIST OF COMPONENTS.		
	s.	d.
1 Panel, 6×6× $\frac{1}{4}$ in. with box	7	0
1 Lamplugh '0005 variable condenser	17	6
1 "Gripco" permanent crystal detector	2	6
2 Coil formers		6
$\frac{1}{4}$ lb. 26 S.W.G. D.C.C. wire	1	3
1 Bretwood single coil holder	1	3
Screws, transfers, etc.	1	6

Most readers of this journal are already aware of the advantages of "Ultra" tuning. But, as a great many new readers have recently asked for another crystal set constructed upon these lines, the set shown in the photographs has been made. It is quite an easy little receiver to construct, employing home-made basket coils. The full list of the components necessary to build the set is given upon this page.

It will be seen that the parts utilised are few in number and not at all expensive. From the photographs given here it will be seen that the receiver is contained in a neat box with a flat ebonite panel. The aerial and earth terminals are to the left of the receiver, and opposite are placed the two terminals for the telephone connections.

The tuning condenser and loading coil sockets are placed centrally, the latter having a short plug-in position when receiving upon short waves. When receiving Daventry it is necessary to remove the shorting plug, and to plug in a 150-turn tuning coil.

The views of the underside of the panel show that there is nothing complicated about the set, the only point which might puzzle a novice being the fact that the aerial coil is separated into two half coils (the small basket coils seen on

either side of the set). The connections are so made that these two small basket coils are united in effect into one aerial coil, working upon the Ultra principle.

In these days, when most listeners take an interest in the circuit which they use, it will be worth while to describe in a few words the underlying idea which has been so successful when embodied in the various "P.W." Ultra circuits. It is well known that in all crystal receivers there are two distinct circuits, the "detector circuits" and the "oscillatory circuit." The crystal and the telephone constitute the main part of the former, whilst the oscillatory circuit consists of the aerial itself, a tuning condenser and coil, and the earth lead.

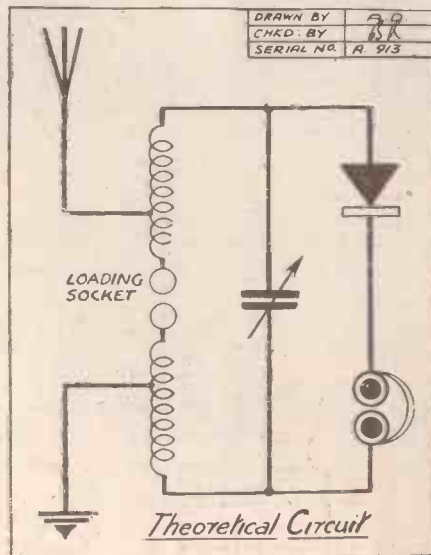
The chief difference in crystal circuits lies in the method of coupling the oscillatory circuit to the detector. There are three main methods in which this can be affected, known respectively as "direct coupling," "inductive" (or "magnetic") "coupling," and "auto-coupling."

Direct and Loose Coupling.

The commonest method is by direct coupling. This consists of connecting the aerial and earth leads direct to a tuned circuit, across which the detecting apparatus ('phones and crystal) is placed. This method has several disadvantages, but it is extremely simple, which to a large degree explains its popularity.

Another plan which is often adopted is to lead the aerial and earth connections to one "primary" coil, which is entirely separated from the circuit to which the detector is connected. If the tuning coil in the latter ("secondary") is placed near the aerial coil, a certain amount of energy will be transferred magnetically across the space between them.

This method is therefore called magnetic or inductive coupling, but it has the



disadvantage of requiring two tuned circuits, one attached to the detector, and the other attached to (and partly consisting of) aerial and earth. Two separate tuning controls are necessary, so in order to obviate this disadvantage, the method known as auto-coupling was evolved.

In auto-coupling there are still the two essential circuits, but part of the set is (Continued on next page.)



The "P.W." Ultra Crystal Set in its completed form but with loading coil removed.

A "P.W." ULTRA SET.

(Continued from previous page.)

common to both of them. This will be seen from the diagram on the previous page. The aerial-earth circuit consists of the aerial lead, 24 turns of the Ultra coil, and the earth lead. (A shorting plug is inserted midway between the earth and aerial leads, and a loading coil is plugged in here when Daventry is being received.)

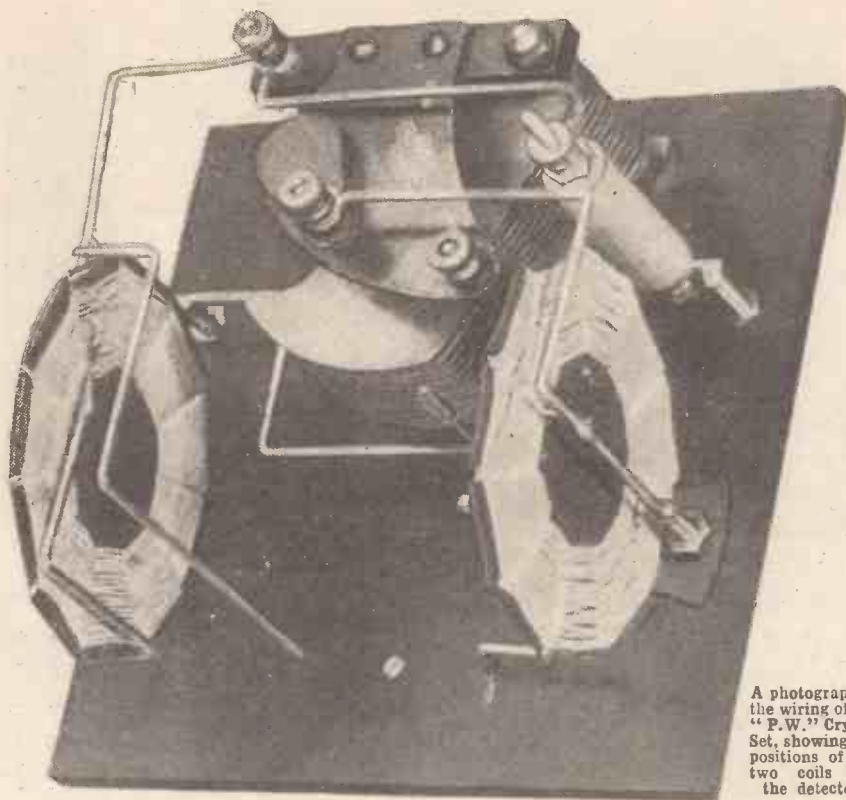
Across the two free ends of the coil is placed a tuning condenser, and in parallel with it are the crystal and telephones. When the local station is broadcasting part of the energy flows through the mid-portion of the Ultra coil, and if the main circuit is tuned to the incoming signals, strong impulses are set up in it, which are rectified by the crystal and heard in the 'phones.

Winding the Coils.

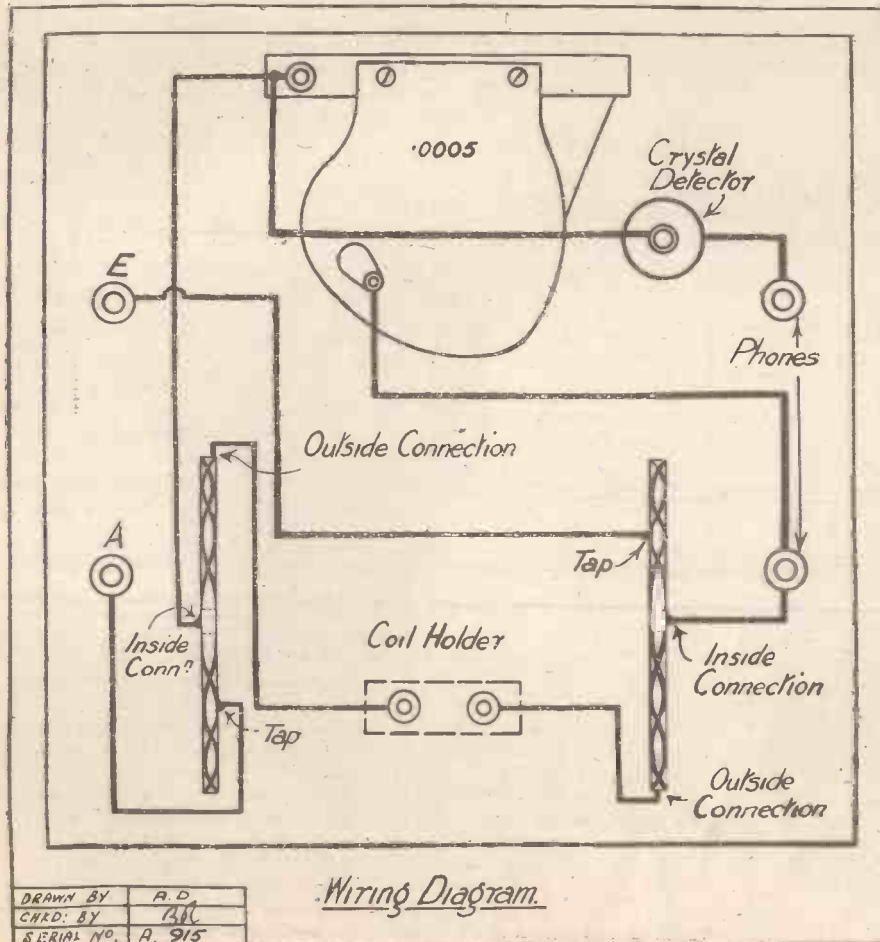
These conditions would obtain if the aerial were placed at the *lower* end of the tuned circuit shown on the diagram, leaving the earth lead as at present connected. But the advantage of the Ultra system lies in the fact that the aerial and earth leads are connected at equal distances from the centre point of the coil, so that the auto-coupling is "balanced."

The first step is to wind the two small basket coils. The former upon which they are made has a diameter of $3\frac{1}{2}$ in. with a centre of $1\frac{1}{2}$ in. Thirty-six turns of No. 26 S.W.G. are wound upon each. When the

24th turn is reached in both cases, a loop is made and left for tapping.



A photograph of the wiring of the "P.W." Crystal Set, showing the positions of the two coils and the detector.



DRAWN BY	A.D.
CHD. BY	131
SERIAL NO.	A. 915

The 36 turns will leave a space of about $\frac{1}{2}$ in. on the outside of the former, so this should be trimmed off with a pair of scissors, except in the case of one section. This is left full length, a hole is made in the centre of it, and, when placed over the shank of the aerial or top 'phone terminal, and bent at right angles, this will hold the coil to the panel.

The drilling of the panel is quite an easy operation, and is carried out in accordance with the drilling diagram on the next page. It will be seen from the photographs that it is not necessary to mount the crystal detector separately, as the little component used in this instance can be fixed securely by its connection to the terminals and to the condenser.

Hints on Operation.

The wiring diagram on this page is self-explanatory, but do not forget when making the connections that the secret of success in the crystal set is good contact. Wherever possible the joints should be soldered, as if they are in any degree inefficient a loss of signal strength will result.

When the wiring has been completed it can be checked over from the list of point-to-point connections, which is given on next page. Great care must be taken to keep the panel clean and free from brass dust, flux, etc.

As the set is such a simple and straightforward one, it is hardly necessary to give further details of operation, etc., but for the sake of the novice the method of connecting up will be briefly outlined. Aerial and earth leads are connected to their respective terminals, and if the local station is to be tuned in a shorting plug should be placed in the coil holder.

Adjust the crystal and vary the tuning condenser until signal strength is obtained.

(Continued on next page.)

A "P.W." ULTRA SET.

(Continued from previous page.)

To change over to the long waves all that is necessary is to remove the shorting plug from the coil holder and replace by a tuning coil having approximately 200 turns. Where a long aerial is employed 175 turns are sometimes better, but anything between

POINT-TO-POINT CONNECTIONS.

Aerial terminal to tap of left-hand coil.
Earth terminal to tap of right-hand coil.
Inside connection of left-hand coil to fixed plates of .0005 variable condenser and to one side of crystal detector. Moving plates of variable condenser to inside connection of right-hand coil and one 'phone terminal. Other 'phone terminal to other side of crystal detector. The outside connections of the left and right-hand coils are taken respectively to the plug and socket of the coil holder.

150 and about 230 turns will generally do, the variation being automatically adjusted by altering the tuning condenser.

It may be as well to point out that any form of tuning coil will do for the loading coil, either basket coils or those of the duolateral type being the most popular.

The Loading Coil.

If desired, it may be a home-made basket coil, but this will be rather bulky. The best way to reduce its size as far as possible is to use "double winding." Instead of taking the wire in and out of every slot, it can be wound into alternate

slots, the resultant coil being thicker, but less fragile, than when the normal slot-winding is employed.

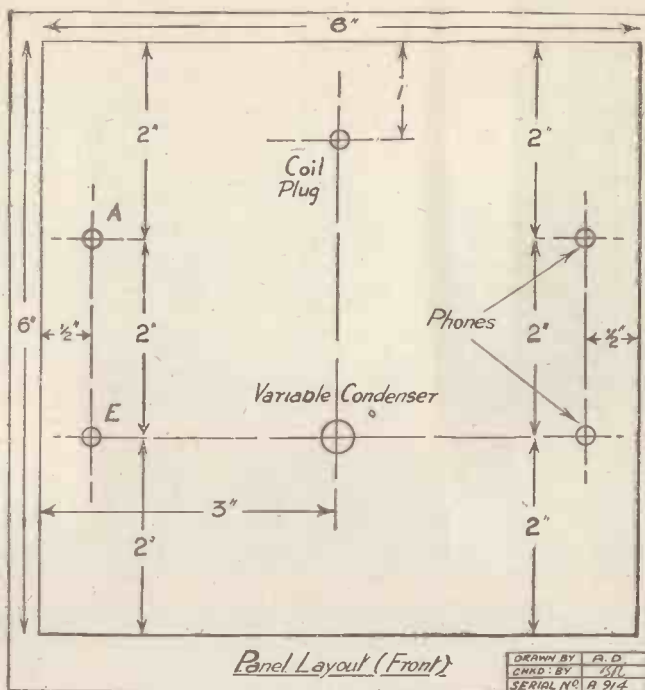
With the original set shown in the illustrations, good signals were obtained from Daventry's morning transmission, both in London itself and in the suburbs. Reception from 2 L O was clear and faultless, and any reader who gets similar results will be delighted with this simple but efficient receiver.

Amplification.

There is no reason, if signals are good, why an L.F. amplifier having either one or more valves should not be added to the "P.W." Ultra Crystal Set in order to enable it to operate a loud speaker.

Unless the signals are really strong—such as those obtainable when the set is within five miles of a broadcasting station—the one-valve amplifier will not be sufficient to operate a loud speaker properly. Two valves, however, should enable this to be carried out up to 15 miles or so from a local main station or 80 miles or so from 5 X X.

Such amplification will not necessarily increase the range of reception of the set,



but can only be relied upon to increase the signal strength of broadcasting that is already audible.

FAULTY COMPONENTS.

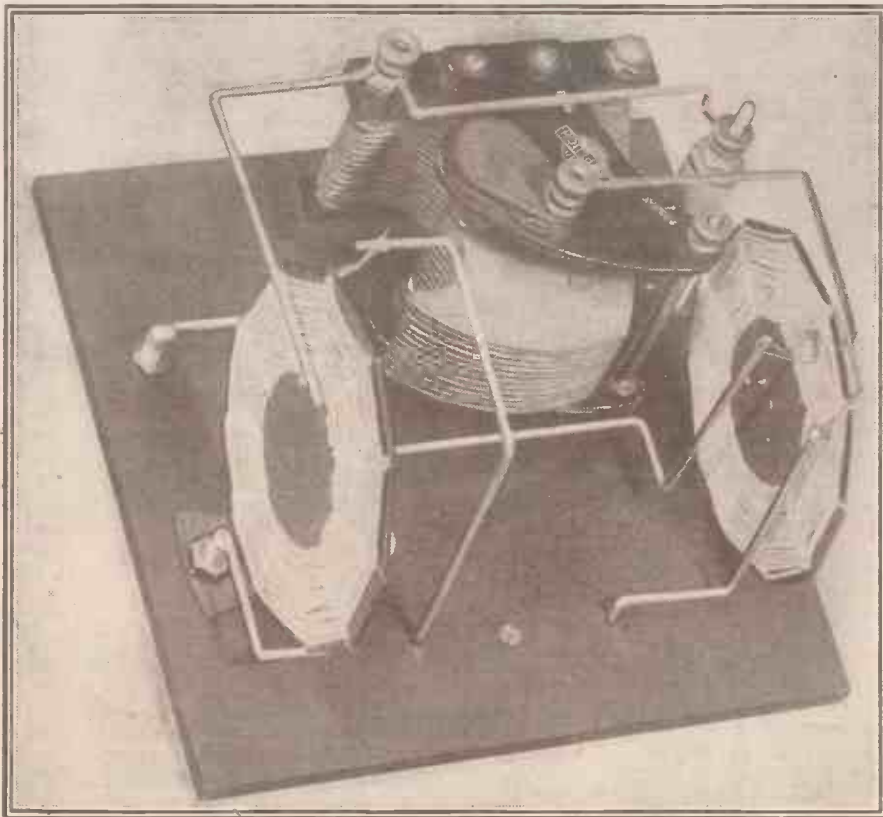
Too few wireless amateurs seem to realise that the whole success or failure of a wireless set depends upon its components, and if these are poor there is almost certainly bound to come a time when troubles will occur.

One of the main pieces of apparatus which can spoil the efficiency of the set is the fixed condenser. Recently the writer set himself the task of dissecting about two dozen fixed condensers of different makes, but according to the markings of the same capacity. Without going into details it is sufficient to say that out of the 24 only two were of the exact capacity stated. As a matter of fact, three of the cheap condensers were actually short-circuiting, which goes to prove how necessary it is to obtain apparatus of reliability.

Too great attention cannot be paid to such things as filament rheostats or resistances. Valves should never light up brightly as soon as the rheostats are the slightest bit "on," otherwise they are liable to burn out very quickly.

A rough-and-ready rule to discover the resistance required is to divide the valve makers figure for filament voltage by the figure for the filament current. Thus, if a valve takes 5 volt, and .65 amp., such as the Marconi R.5V. a filament rheostat of approximately 8 ohms max. will be required.

What is more important, however, is the fact that the filament rheostat, as well as having a resistance of 8 ohms, must have wire sufficiently thick to carry .65 amp., otherwise it will heat up and either offer a further slight resistance which, if receiving a distant station, might upset the working of the set or else fuse, scorch the panel, and possibly set something on fire.



Another underpanel view of the crystal set which should be useful when the receiver is being wired up.



Conducted by our Staff Consultant, J. H. T. ROBERTS, D.Sc., F.Inst.P.

THE many readers who have written me with regard to high-tension eliminators will be interested in a new multi-filament rectifying valve which has lately been patented by H. W. Houck, and which is intended for the purpose of full-wave rectification of single-phase current. The circuit with which the valve is used includes a transformer with a centre-tapped secondary, the centre being connected through a condenser to the central non-emissive electrode or plate of the rectifying valve. The two filaments (in this case the valve is a double filament valve) are placed on opposite sides of this anode, and are connected to the two ends of the secondary of the transformer. The transformer also carries two extra secondary windings which are in series with the main winding, and which are connected respectively to the two filaments for the purpose of filament heating. It might at first be thought that a single extra secondary could be used for heating both of the filaments in series or in parallel, but it will be recollected that the two filaments are operating to rectify the two halves of the wave, and are therefore operative alternatively, so that they must not be connected together to the same winding.

"Aperiodic" and "Untuned."

Controversy has lately taken place in a contemporary on the confusion which frequently arises between the terms "aperiodic" and "untuned." Readers in their letters to me frequently use these terms in a way which shows that they are confused together, and there seems to be little doubt that many people regard them as being more or less synonymous.

The two terms, however, describe quite different qualities. A circuit which is untuned is not necessarily aperiodic. Any ordinary circuit has a definite natural frequency of oscillation and it can, by suitable adjustment of the inductance or capacity, be made to have, within limits,

any desired natural frequency of oscillation or, to put the matter into simpler language, it may be tuned to any wave-length within its range. When it is receiving oscillations which are not in tune with its resonance-frequency its sensitivity, or, in other words, the amplitude of the oscillations which are set up in it, will be less than if it be tuned to the received oscillations. But because the circuit is out of tune with the received oscillations it does not mean that it has the properties of an aperiodic circuit.

An aperiodic oscillatory system (whether

resistance, or rather upon the relation of the resistance to the inductance and capacity of the circuit. If the resistance exceeds a certain critical value, which depends, as already mentioned, on the inductance and capacity, the circuit will be aperiodic (in the limited sense indicated above), whereas if the resistance is below the critical value the circuit will not be aperiodic.

It need hardly be added that in order to increase selectivity (in other words, in order to sharpen the tuning) damping in the circuit must be reduced as much as possible, and this is done by reducing the resistance in the circuit.

Metres or Kilocycles?

My recent reference to the straight-line-frequency and straight-line-wave-length condensers has brought me a number of inquiries from readers of these Notes on the question of the merits of metres and kilocycles as a system for the designation of wireless waves. It is probably well-known that the system of kilocycles has gained ground in the United States, whereas the metre designation still holds the field in this country. As a matter of fact, speaking generally it is more scientific (or rather, it is a method which is more commonly adopted in other branches of science) to refer to the frequency of waves rather than to their



During the recent general strike hundreds of people were attracted to the Ediswan showrooms, upon the windows of which the wireless news bulletins were displayed

it be an electrical or a mechanical system) is one which has no natural frequency of vibration, and is therefore open to respond indifferently to vibrations of any frequency. Strictly speaking, such a thing as a truly aperiodic vibratory system is unlikely to exist in practice, for the natural frequency of vibration of a vibratory system depends upon a quantity corresponding to mass, and a quantity corresponding to the restoring force tending to restore the system to its original condition after any displacement in it has taken place.

Effect of Resistance.

It is usual to assume that an aperiodic system responds with equal efficiency to all frequencies, although in practice this is far from being the case with any so-called aperiodic system.

In wireless circuits the comparative aperiodicity of a circuit depends upon its

wave-length. For example, in the science of acoustics we speak of the pitch of a note according to its frequency, and not according to its wave-length. No doubt the fundamental reason for this is that the wave-length depends upon the medium through which the waves are travelling (since it depends upon the velocity of the waves, and the velocity depends upon the medium), whereas the frequency is constant and does not change with the transition from one medium to another.

How wave-lengths came to be adopted in connection with wireless waves it is difficult to find out. There is no reason at all why frequency should not be used and, in fact, as I mentioned some time ago, many of the United States experts consider that the frequency-difference between stations is a more reliable indication of their freedom

(Continued on page 629.)

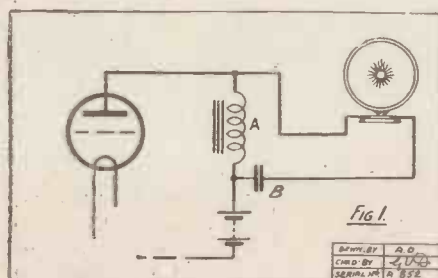
LOUD SPEAKER EXTENSIONS

MECHANICALLY it is simplicity itself to run loud-speaker extension leads all over the house. Quite thin wire can be used, and it can be run along picture rails, through door frames, along the skirting and underneath carpets and linoleum, or even beneath the floor boards without great difficulty. But certain precautions at the set itself must be taken, for instance, among other things it is desirable to isolate the H.T. Obviously, it is bad practice to have 100 or so volts H.T. running around the house through amateur wiring; there is even a risk of fire to be considered; it is slight, no doubt, but nevertheless it is there. Again, it is undesirable to have the anode circuit of the last stage of L.F. wandering upstairs and downstairs. It should be confined to the



harmful during the hours of reception. The least that would happen would be a series of disconcerting "atmospherics" of an artificial nature.

Changing the position of the fixed condenser in Fig. 2 to that shown in Fig. 1 does not help much. It brings the choke in series with the positively "charged" leads and thus prevents absolute "shorts" occurring by the above means, but it would not eliminate "X's" through poorly insulated extension leads. But another fixed condenser of similar value can be brought in as per Fig. 3, and this provides perfect



set, where its constants and characteristics can be controlled, a state of affairs which is as efficient as it is alliterative.

Incomplete H.T. Isolation.

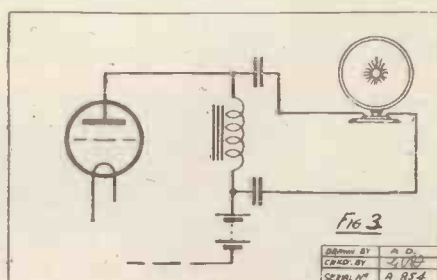
It can be attained in quite a simple manner. Fig. 1 is a circuit representing the popular choke-condenser method of shunting the loud speaker. The L.F. choke A can consist of the secondary winding of an ordinary L.F. transformer, although, of course, proper chokes are freely available, while B is a large fixed condenser of the order of $\frac{1}{2}$ mfd. or so. This value is by no means critical, but must be sufficiently large to bypass L.F. currents. The choke completes the anode circuit, and while it offers a reasonable ohmic resistance to the steady plate current, it tends to choke the L.F. variations caused in it. These alternating impulses are by-passed to the extension circuit which, of course, by virtue

A USEFUL ARTICLE FOR EVERY AMATEUR

By G. V. DOWDING, Grad.I.E.E.
(Technical Editor.)

of the introduction of a series condenser offers an infinitely high resistance to steady anode currents.

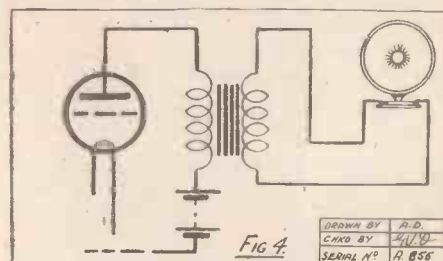
But this scheme does not afford complete H.T. isolation. Referring to Fig. 2, it will be seen that the whole length of one extension lead, the loud speaker, and practically the whole of the other lead, are connected metallically to the positive terminal of the H.T. battery. Now it will also be seen that the negative terminal is similarly connected to earth and also, of course, to the earth lead and aerial lead. Therefore, unless all those points marked + in the diagram are very well insulated from those marked - or anything that is earthed, the H.T. battery will be able to discover a circuit through which it could discharge even during periods when the set is out of commission. Naturally the rate of discharge would depend upon the resistance of the "earth," but it could, in the case of negligent wiring, easily be a dead "short." Disconnecting the H.T. battery when the set is out of use would prevent such occurrences during those periods, but a "short" or a bad leak would be just as



safety. A one-to-one ratio L.F. transformer can also be used, as shown in Fig. 4, but personally we prefer the choke-capacity method.

Series and Parallel Wiring.

Having incorporated an efficient shunt system inside the set or additionally to it in the form of a small unit, greater latitude is allowed in the wiring of the distant points. Thin wire can be used, and no great care need be taken in the matter of insulation. Of course, conscientious amateurs will not string up their leads in an

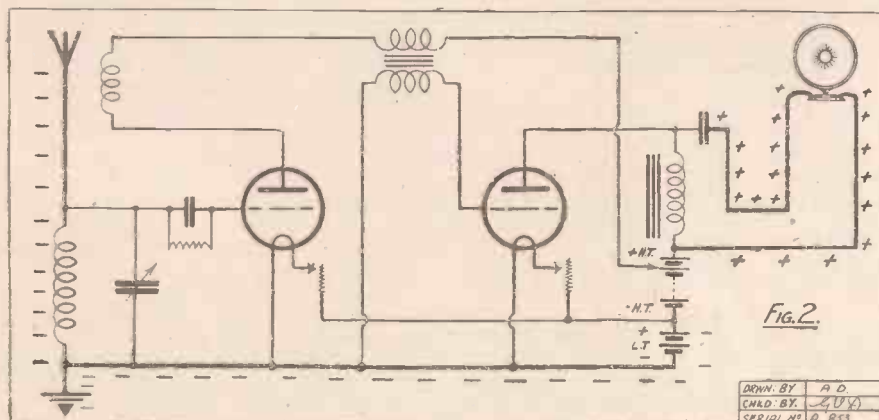


untidy haphazard manner, but it will be unnecessary for them to employ expensive rubber-covered cable.

Now, if only one loud speaker is to be used and is to be carried from room to room, the various points can be wired in parallel. For the sake of example we will suppose that the receiver is installed in one room and it is desired to have extensions to two others. We will call the former A, and the latter B and C. Fig. 5 shows the points wired in parallel. Those points not required are left "open"—i.e. the two ends of each unused extension are kept apart and are not joined together.

If it is desired to operate two or three loud speakers simultaneously, the points

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LOUD-SPEAKER EXTENSIONS.

(Continued from previous page.)

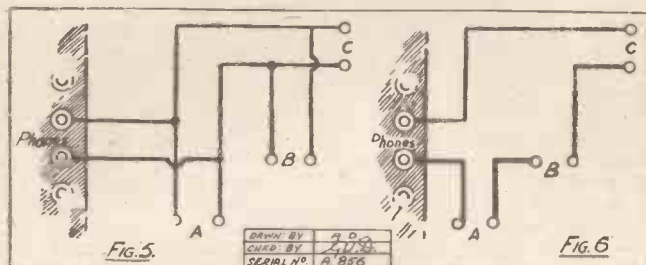
should be wired in series, as shown in Fig. 6. In this case the unused points should be "shorted," their two ends joined together.

Amateurs contemplating the installation of extension leads would be well advised to adopt the latter method (Fig. 6), for it is almost as efficient for single-speaker work as Fig. 5, and it always permits the use of another speaker should the occasion ever arise. A refinement in the case of Fig. 6 would be the addition of a switch at each point to "short" it when not in use.

Better than having loose ends of wire terminating each extension is to have a neat little terminal board or wall plug mounted on the wall. A shelf can be provided for the speaker itself just beneath such a fitment.

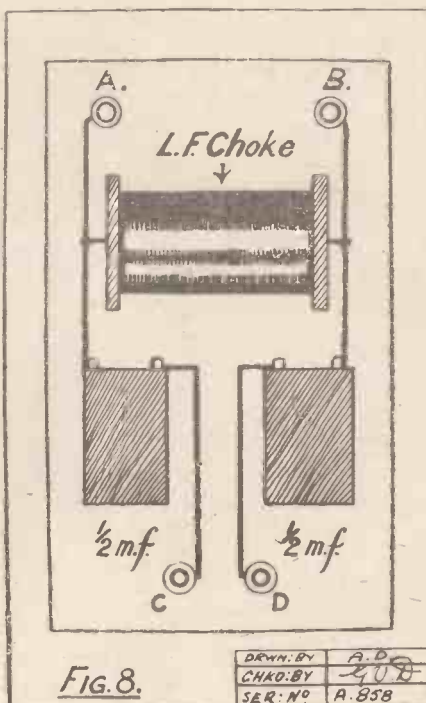
Serving a Dual Purpose.

An interesting development of loud-speaker extensions is to employ them as an indoor aerial. The idea was introduced by the writer some year or two ago, and in many cases has given very satisfactory results. Especially when the extensions are run to or through two or more rooms are good results provided. As a matter of interest a typical circuit employing the system is given in Fig. 7.



It is very simple. The aerial terminal of the set is connected via a fixed condenser to the loud-speaker extension circuit. That is all there is to it, but it should be noted that the choke and condensers are essential to this system.

An efficient choke unit for attaching to an existing set can easily be made. All that is required is an L.F. choke (Lissen's, 10s.), two $\frac{1}{2}$ mfd. Mansbridge condensers (T.C.C., 3s. 4d. each), and a small case and panel and four terminals. Fig. 8 is a pictorial-wiring diagram of such a unit. Terminals



A and B should be connected to the 'phone or loud speaker terminals of the set, and the extension leads to C and D. The inclusion of such an instrument not only makes the wiring easier and safer, but actually improves reproduction, more especially in cases where the H.T. battery is on the downward path of deterioration.

We have not dealt with the subject of "remote control" in this article, for space does not permit; but at some future date we hope to be able to say a few words about it.

CAPACITY AND OTHER EFFECTS.

From a Correspondent.

NOTHING can be more tantalising than evanescent increases of signal strength. Ordinary faults are annoying enough, but once traced and rectified they can be forgotten. On the other hand, a receiver may give fairly satisfactory service for months, and then one night the amateur might do something and an enormous increase in volume eventuate for a while, and then—unexciting normality again.

After that, how can he remain at peace with his radio outfit until

the "something" has been permanently duplicated?

Condition to be Avoided.

It frequently happens that the condition is very difficult even for an expert to discover, but wireless is a sufficiently exact science these days to allow us to repeat the most elusive phenomena with more or less exactitude—if we know how to go about it!

Capacity effects account for a great deal of these fleeting increases. The hand may be placed in close proximity to an H.F. component and cause a closer approach to reaction oscillation than is provided by the usual reaction adjustment. This will mean louder signals, but will probably introduce distortion, and is not a condition that should be permanently maintained, for the receiver will be prone at any time to break into violent oscillation and cause interference.

Fine Tuning Effects.

The human body, or, indeed, almost any thing or substance, will affect the tuning of a wireless receiver when placed near it or taken away from it, but a set should not be so critical that such an effect should cause either "howling" or appreciable signal strength variations. If it does, then there is not a sufficiently large margin of safety or the set is badly designed.

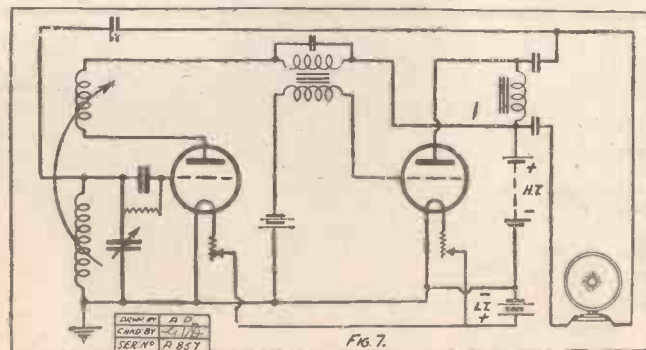
Curiously enough, many aspiring inventors fall by the wayside of vernier tuning. They build an ordinary sort of receiver, and while it is in operation drop in a piece of gear which merely has the effect of fine tuning, an effect which could be duplicated by a vernier attachment of conventional design.

When a signal strength increase is caused by touching the earth terminal with a finger, and the increase is not attended by distortion or a closer approach to oscillation, then it is a fairly clear sign that the earth connection is not as efficient as it should be. Perhaps the earth lead is too long and of too fine a gauge, or the water-pipe or earth-plate connection requires attention.

Reflex Experiments.

In the case of reflex receivers many peculiar things sometimes happen when a little capacity is introduced here or there, or a resistance connects this or that point. It is always worth while to run over such a set with a fixed condenser or two. The component should have a couple of leads joined to it, and these should be touched on various points. No harm can be done, and, in any case, it is an interesting experience even if only peculiar howls eventuate. The same can be done with a grid leak or anode resistance. If signal strength or tone or both improves, there is no reason why such a temporary connection should not be made permanent, however unconventional it looks on paper when incorporated in a diagram.

On the other hand, the arrangement might be quite orthodox, such as loading the secondary of an L.F. transformer or increasing the capacity shunt of its primary, but in either case it is the practical effect which matters.



I THINK it would be the greatest mistake, from every point of view, if politics ever find or force their way into wireless programmes, or any party makes broadcasting a medium for political propaganda.

Broadcasting should always be a form of relaxation—mental gymnastics, if you like, and education, but primarily artistic education.

* Party politicians make the ridiculous mistake of thinking that everyone "born into this world alive is either a little Liberal or else a little Conservative," unless they happen to be born "red" or born to labour. This is an untruism. Thousands of people care nothing for politics, and yet they are sufficiently "alive" to be responsive to music, to humour, to travel talks, to delightful lectures about animals, and other interesting items of the B.B.C. programmes.

Listening to the World.

And even if politically disposed—or indisposed—they don't want to have politics thrust at them in their hours of leisure.

I, myself, would be simply bored and distressed if, after taking the trouble to "get" London (which, by the way, I hate—I am in the position of Mohamet and the Mountain, I can't bear going to London, so London has to come to me, on long or short waves!) I should find Winston Churchill talking to me. I could, and would, only switch off; but what a waste of an evening, and how destructive to one's natural courtesy!

No, I think the wonderful thing about broadcasting is the way that it brings the world to people who cannot go into the world, as we know it.

For instance, the stalkers in the northernmost parts of Scotland! Far beyond railway heads and the Automobile Association's tested roads, they are snowed up for six months of the year and were entirely cut off from civilisation; but now they all have their wireless sets, and in the bleak, frozen winter evenings can sit round their peat fires and "listen-in" to Rachmaninoff, to dance bands to which "London folk" are dislocating and syncopating their femoral and pedal muscles, to the humour of John Henry, and travel talks from people who have crossed the "imaginary lion," and have traversed Africa or Asia or whatever is at the moment the fashionably unknown corner of the globe—for in these days of marvels even globes have corners!

The Children's Hour.

They can even, in the Woman's Hour, be made *au courant* with the fashions. One can only hope that the Gillie and the Stalker will not "make over" his kilt into yard wide "trews," and that small felt hats and abbreviated skirts will not supplement the plaid shawl of his mate. One imagines, not, for if humour, like the Tee, flows South, the Southerners supply the Highlanders with at least as many jokes as bawbees.

I don't know very much about the Children's Hour. My own grandchildren and the children and grandchildren of my

MY VIEWS ON BROADCASTING.

An Educated Democracy.

By THE COUNTESS OF WARWICK.

We publish with pleasure in this issue an article on Broadcasting, by the Countess of Warwick, who for many years has worked indefatigably on behalf of British Democracy. Her Labour College at Easton Dunmow is world famous, and in this article she shows an appreciation of the work of the B.B.C. which our readers will note with interest.—THE EDITOR.

friends seem to be rather bored by it, but I believe it is tremendously appreciated by the village children.

Concerning the Programmes.

They have it in schools now, and I know of one in Devonshire where it is an immense success. The children love it, and go home full of enthusiasm and the new interests it evokes.

For instance, they try to put into practice the gardening hints they have received. This must be a boon to their parents, for a busy and interested child is a good child, as well as being an important factor in their development, and so is another step towards an end which I have tremendously at heart, for, as you know, one of my dreams is an educated democracy.

I know that the B.B.C. programmes have been criticised, but I must say that I think

they are quite wonderful in their catholicity considering the extraordinary variety of interests and tastes of the public they have to cater for.

I admit that the outside aerial does make me feel that I am more in touch with the world, but I agree that it is un-aesthetic, and that an aerial on a thatched cottage is an anachronism. And, of course, it ties

one down to one place. The most modern listening-in sets which one can pick up and carry from one room to another seem to me even more miraculous.

Of course, I understand nothing about the scientific side of wireless. To me it is just a marvel—and it has all happened in such a short time. When one thinks that people who are ill in bed, as well as those thousands of miles from any sort of intellectual life, can keep in touch with everything that is going on in our very fast-moving world, I can only express awe, amazement, and admiration.

OBTAINING VOLUME WITHOUT DISTORTION.

By G. V. COLLE.

IT is a curious fact that many constructors will buy any apparatus that comes to hand, regardless of its quality, literally "throw" it together, and then expect maximum results.

To obtain the best out of a set it is useless to buy cheap apparatus just because it is cheap. Maximum volume and clarity can only be obtained by careful selection of components.

Many good sets, however, are spoilt by the absence of little refinements such as grid bias, while incorrect condenser capacities and the use of ordinary valves on the last stages of L.F. all play their part in ruining results.

What usually happens in this case is that the builder when testing the set out, discovers that it gives a big volume but is also very harsh, and he places a variable anode resistance or a condenser across the secondary of the second L.F. transformer. This certainly decreases the harshness, but it also "damps" the volume at the same time.

Prevention is always better than cure, and constructors should always fit L.F. transformers of suitable ratios with separate H.T. tapings and grid bias, and use power valves which really will carry the required energy.

Distortion or thin music in L.F. amplifiers can also be caused by poor transformers or incorrect combinations of resistances and capacities, if the set happens to be resistance-capacity coupled.

A good L.F. transformer should have the following features: A substantial iron core with the laminations or wires constituting the core overlapping, a bobbin well covered to resist dampness (the greatest enemy of any L.F. transformer), no bolts passing through the iron laminations, and a reasonable amount of wire on the primary and secondary.



The Countess of Warwick.

BROADCAST NOTES.

By O. H. M.

"Provided" Programmes—Banned Russian Talks—Music Halls and the B.B.C.—A New Attack—Dance Bands—Applause in Studios—The Up-keep of Critics' Sets.

I AM very sorry to note the disappearance of the Two-Minute Topics. There was general agreement among competent critics that these were excellent. Once the objectionable word "editorial" was dropped, and controversy was avoided, all was well with the new feature. It may be that it is merely hung up for a week or so, but many listeners have noticed its omission recently, and have resented it.

"Provided" Programmes.

It is good news that there has been a change of policy at the B.B.C. with regard to the acceptance of "provided" programme material for studio performances. This practice is to cease forthwith, and existing arrangements of the kind have been cancelled. There was a period when it was more than desirable that our broadcasters should take material from outside, and, as long as it was up to standard, place their studios at the disposal of the providers. But British broadcasting has now outgrown this stage in its development. The Savoy Hill people should now stand on their own feet. The advertisement factor can never be eliminated, but it should be steadily diminished.

Banned Russian Talks.

When in the lobby the other day I was told by one of the Unionist Members, who went to Russia on the Special Mission, that the B.B.C. had declined to allow them to broadcast anything about their experiences or impressions. I remarked at the time that there was probably more in this rejection than my friend realised. Subsequent inquiries have elicited the information that it was the Post Office and not the B.B.C. which banned this talk. While on this subject of tightening censorship, I should add that there is a good deal of indignation in the boot and shoe trade at the Post Office ban on the broadcasting of an agreed statement on how disputes are settled in that progressive industry. It is profoundly to be hoped that the present tightening-up does not foreshadow a "safety-first" policy for the new broadcasting regime.

Music Halls and B.B.C.

The music-hall front of broadcasting has become active once more. For some time past tentative efforts have been made by the B.B.C. and by disinterested persons, to bring about a settlement, perhaps on the lines of the agreement which works so well between the theatres and the B.B.C. But all these overtures and efforts have come to nothing. The vaudeville people have decided to conduct a vigorous offensive against broadcasting. One of the best-known managers declared a few days ago that he and his colleagues had plans in hand which would wreck the broadcasting programmes and drive the service out of existence.

Further inquiries leave no doubt in my mind of the determination and truculence of this new offensive against the B.B.C. Apparently the music-hall people had hoped for a time that they would be able to control the drafting of the new broadcasting legislation, that they would throttle its further progress constitutionally. But the B.B.C. headed off this move, and others of the same kind. The future of broadcasting has been the focus of a seething mass of interested intrigue, plots, and counter-plots, and it speaks volumes for the sagacity and clear-headedness of the Savoy Hill people that they have gone straight ahead, defeating each move as it was made.

The new attack will be the more interesting because of necessity it must be carried out in the open. The first step, already taken, is to threaten heavy penalties against any music-hall artistes who broadcast. In fact, a clause absolutely barring broadcasting for all time is being introduced into all music-hall contracts on the big circuits.

NEXT WEEK

How to Make A COLPITT'S ONE-VALVE RECEIVER

This is one of the most sensitive and selective one-valvers in existence. It will operate a medium sized loud speaker within reasonable ranges of the local station, and is excellent for DX work.

Our usual diagrams, point-to-point check list, clear photographs, etc., will accompany the description of this receiver, which is as simple to construct as it is efficient in operation.

ORDER YOUR COPY NOW!

The immediate effect of this is certainly to withdraw a certain number of artistes from B.B.C. work.

The managers are seriously miscalculating, however, if they think any action of the kind will either stop or cripple broadcasting. The B.B.C., having exhausted all the possibilities of a peaceful arrangement, is accepting the challenge, and will fight with all its tremendous resources. Plans have been completed for the substitution of music-hall contract artistes. Microphone stars will be developed, special broadcast material will be provided, and the challenge of the music-halls will be met with calculated competition from B.B.C. stations all over the country. Anyway, listeners as a whole will look to the B.B.C. to crush the challenge and carry the war deep into the enemy's country.

The opera "Philemon and Baucis," speci-

ally arranged in view of the Tercentenary of the City of Leeds, will be conducted by Mr. Percy Pitt in the Leeds Studio on July 13th, and relayed to Davenport.

I hear arrangements are in hand for a special Jewish programme which will include a broadcast from a synagogue during one of the Jewish religious festivals in September.

Dominion Day.

I was very interested to hear that Lord Beaverbrook is to introduce the Dominion Day programme from the London station on July 1st. Lord Beaverbrook has kept well away from the microphone in the past, but I imagine the opportunity of doing a good turn for Canada has prevailed on him this time.

Much of the difficulty hitherto experienced with regard to the effectiveness of dance bands in studios appears to have been overcome by the use of the new echo rooms. Thus the London Radio Dance Band, playing with the echo room adjunct, sounds quite different, and has lost the suspicion of thinness which characterised some of its earlier performances before the echo rooms were evolved.

The Applause Controversy.

There is a revival of controversy about applause in broadcasting studios. There has been a growth of the practice at London recently, and the critics are about evenly divided as to its merits. My own view is that, on the whole, applause is not normally a desirable accessory to a studio performance. The point is that listeners do not desire to have their own opinion of individual items anticipated in any artificial manner. Applause in a studio by its very nature must be largely artificial. There are certain occasions, of course, when applause is essential to a successful performance, but for the ordinary run of items it is not only superfluous but positively annoying.

There is growing dissatisfaction in the Critics Circle because the B.B.C. is not over-generous with the issue and up-keep of free receiving sets. I heard a good deal of bitter grouching the other night on this subject. One eminent critic told me that after being provided with a set he has been almost entirely neglected technically, until the other day he was asked whether he was using the set. He thought that as the B.B.C. had not taken the trouble to maintain the set, they had no business to make impertinent inquiries about whether it was in use.

Crystal Sets Only.

Other critics have complained because they were provided with crystals only. I can sympathise with the critics, knowing how differently they are treated by the other branches of the entertainment industry. But they should remember that the B.B.C.'s position is one of exceptional difficulty. First of all, it is extremely hard up; secondly, it is not a manufacturing concern; and, thirdly, it has not been well treated by the critics as a whole. Of course, the right solution of this difficulty is the provision in the West End of an appropriately furnished listening salon, where critics can drop in at any time on their rounds of theatres and concerts.

THE Trinadyne circuits described in this journal by Mr. J. English have many points of particular interest to the experimenter; in particular are they of interest as compared with the popular one valve-crystal reflex type of circuit. On analysis the Trinadyne circuit will be found to consist of a crystal detector followed by one L.F. amplifier valve, and, in addition, a means provided whereby the valve may be caused to create a reaction effect on to the aerial. A circuit of this type is illustrated in Fig. 1, it having been originally described in No. 180 of Vol. VIII. of this journal by the inventor.

The reflex circuit using one valve, on the other hand, will, on analysis, be found to

NOTES ON THE TRINADYNE CIRCUITS.

Points of Interest for the Experimenter.

FROM A SPECIAL CORRESPONDENT.

the point of oscillation in the case of the Trinadyne circuit?

There is one point upon which the reflex circuit scores very heavily over the Trinadyne circuit, namely that of selectivity. In the case of the latter circuit the aerial circuit is very heavily damped by the presence of the crystal detector and the secondary of the L.F. transformer. Thus the tuning will become very flat, and moreover there is only one tuning control. In the case of the reflex circuit there are two tuning controls, and the damping on neither is as great as the damping on the one control of the Trinadyne circuit. Thus, though a reflex circuit is never looked upon as the last word in selectivity, a Trinadyne circuit is even more unselective.

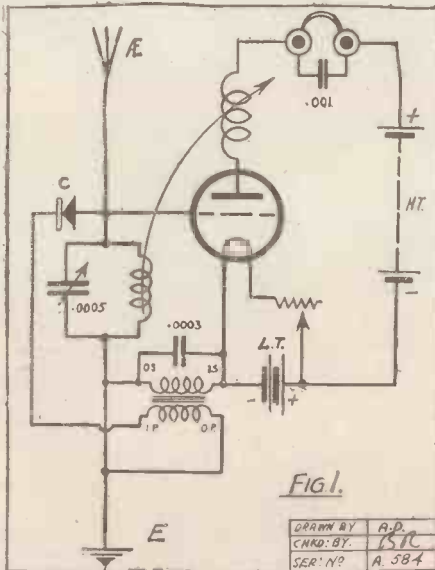
A Useful Switch.

There are a great many more points which might be raised whilst discussing the respective merits of the Trinadyne and reflex circuits, but they would all leave the question of which is the better circuit unanswered. Therefore, reasoning along the same lines as those followed by the old sage who first gave utterance to the adage, "The proof of the pudding is in the eating," a receiver has been designed in which, by means of one simple switch, it is possible to change from a single valve reflex receiver to a Trinadyne receiver. The reflex circuit used is essentially the same as one described by myself in this journal some time ago, and which has solicited many complimentary testimonials.

The Trinadyne portion of the circuit is a slight modification of the circuit shown in Fig. 1, all the essential features being the

same, the only difference being in the arrangement of the reaction coil, etc. The complete circuit is shown in Fig. 2, and its simplicity will be at once apparent. The switch S, when in the left-hand position, connects the crystal detector to the aerial tuning coil instead of to the anode tuning coil, as is the case when the switch is in the right-hand position.

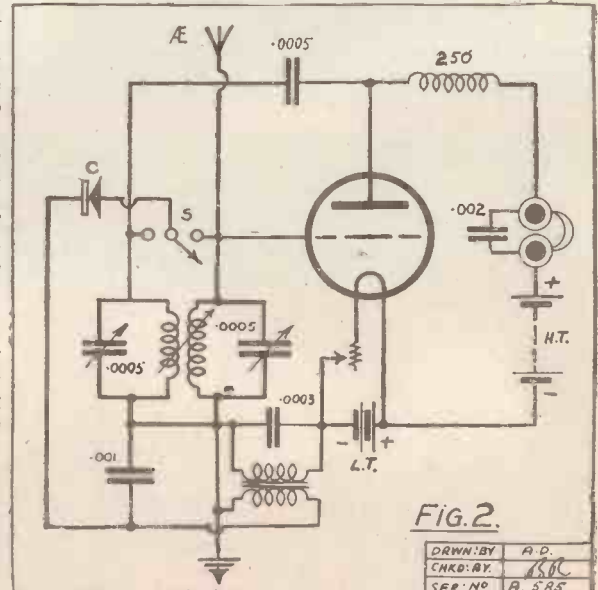
Thus, when the switch is in the right-hand position the set functions as a reflex receiver, whilst when the switch is in the left-hand position the set will function as a Trinadyne receiver. By using this circuit the experimenter will have a circuit that will permit of a really conclusive comparison between the two circuits, as the only



incorporate one H.F. stage, with reaction, a crystal detector, and one stage of L.F. amplification. Thus in theory at least the reflex circuit should give superior results to the Trinadyne circuits, in particular when DX reception is in progress. Now, on the other hand, the reflex circuit has many faults which are entirely missing in the case of the Trinadyne circuit; firstly, in the reflex circuit, the primary of the L.F. transformer is connected in the anode circuit of the valve, and the secondary of this component is connected in the grid circuit of the same valve.

Where the Reflex Scores.

This means that L.F. reaction can very readily occur; the proof of this lies in merely removing the anode tuning coil from its position in the anode circuit, when the receiver will almost certainly buzz loudly. In practice, the effect of this tendency toward L.F. reaction makes it impossible to operate the receiver on the point of oscillation, as under these circumstances the receiver will usually buzz. This effect is entirely absent in the case of the Trinadyne circuit, which makes it possible to operate the set very much nearer the oscillation point. The question thus resolves itself, which is of more value, the stage of H.F. amplification attendant upon the reflex circuit, or the ability to work nearer



adjustment necessary besides the throwing over of the switch from one position to the other will be a slight readjustment of the reaction coil.

The comparative results will almost certainly be found to vary with different aerials, and it will also probably be observed that one circuit will give louder results on the local station whilst the other circuit will be found to give louder results on distant stations.

Thus a very "versatile" receiver results and one that is capable of providing a high order of efficiency under varying conditions. In certain instances the performances of the two circuits will be found to vary to an extraordinary degree while yet both are perfectly satisfactory for either one purpose or another.



One of the beds at the Bradford Royal Infirmary which has been equipped with wireless by Bradford art students.

THE B.B.C. seem to have made up their minds to reorganise the broadcasting system at present in use in Great Britain. The main idea is to change the distribution so satisfactorily that every type of listener will be able to enjoy uninterrupted service, whether a crystal set or a multi-valve set be used for reception.

This means, of course, that higher power than is at present employed at the various B.B.C. stations will have to be decided on.

Too Many Stations.

This reorganisation of the B.B.C. transmitting stations has been much talked of for some months past, and it was obvious to everyone who had studied British broadcasting that some such reorganisation would have to be brought about. There are at present far too many stations, and we have all along advocated a policy of reduction in their number, and either a limited number operating as super-stations, or a reduction of the number of stations at present in use and the remaining stations to have their power increased so as to cover all areas in the country.

It is as yet too early to write about the details of this reorganisation scheme, but it seems now certain that as a result of it there will be fewer stations, and those stations in use will broadcast on a much higher power than is at present being used by the B.B.C. main and relay stations.

The B.B.C. aims to give 85 per cent. of the population of Great Britain wireless service, and it is its laudable object to bring this up to 100 per cent. The idea is to provide a choice of programmes, not of a sort which can only be received at their best by powerful multi-valve sets, but also alternative programmes for the crystal user or the listener with the one-valve set.

If the B.B.C. scheme goes through as at present planned, these programmes will be broadcast at equal strength as regards power, but, of course, there are still the tortuous paths of negotiation with the Post Office to be straightened out. There is also a good deal of experimental work to be done, and this is the prime reason why the B.B.C.'s new experimental station at Daventry is being pushed on as quickly as possible.

If this station lives up to expectations, and permission can then be obtained to build a number of high-power stations, it is quite likely that the existing system will go by the board. The replacing of the B.B.C. low-power stations by a few high-power stations will probably be carried out in such a way that there would be overlapping of areas. This would not create interference, but would enable listeners to choose an alternative programme, and should one station break down there would be no difficulty in picking up another.

We understand on good authority that this new scheme does not suggest that 2 L O should be displaced.

The Oscillation Evil.

The B.B.C. have again drawn attention to the growing oscillation nuisance in various parts of the country. So bad is this nuisance becoming that the B.B.C. find from their statistics that in many places good reception is practically impossible. The B.B.C. are continually appealing to listeners to put an end to this trouble, but after three, or nearly four, years it is growing worse. Something stronger than an appeal is needed.

CURRENT TOPICS.

By THE EDITOR.

Reorganising Broadcasting—
Reducing Small Power Stations—
The Progressive Policy—The
Oscillation Evil—The Cure—
Sir Oliver Lodge's Remedy—
"Get on with the Job."

Only recently we have drawn the attention of our readers and the general public to the new non-oscillating receiver invented by Sir Oliver Lodge, and we ask the B.B.C. why they have not approached Sir Oliver Lodge with regard to this new receiver. We regret to speak so plainly, but we feel it our duty to protest most strongly at the way in which the B.B.C. regard outside efforts of this nature.

Long before any B.B.C. official was born, and long before any B.B.C. official had learned the difference between a valve and a crystal, Sir Oliver Lodge and other experts had spent many years of their lives in wireless research.

We have, at the inventor's request, tested this Lodge "N" circuit; we have built many models; and we have proved beyond a shadow of a doubt that of all the simple

campaign to bring it home to the public in a way which only the B.B.C., with its extraordinary organisation for propaganda, can do.

We have done our best to put the matter before our readers and the general public, and we are glad to say that Sir Oliver Lodge is in negotiation now with a certain firm, and if all goes well this receiver will be on the market before the end of the year. But this is a receiver which the B.B.C. should closely investigate, and to which they should give their support. We have been waiting for many weeks now to hear that the B.B.C. have invited Sir Oliver Lodge to demonstrate this receiver to them.

The Remedy.

It may be owing to the publication in "P.W." of the details of the "N" receiver, that the B.B.C. feel that it would not be politic for them to link themselves in any way with a receiver, the details of which have appeared in a wireless journal. If this is so, we regret it very much. We have no proprietary interest in this invention. As our scientific adviser, we obtained from Sir Oliver Lodge, on business terms,



Lady Astor broadcasting from 2 L O.

two-valve, or three-valve receivers on the market, there is nothing to touch the "N" circuit as regards simplicity, efficiency and general suitability for the listening public.

The two-valve "N" receiver is capable of giving loud-speaker volume equal to any other two-valve set of straight circuit reaction type, and of infinitely better quality. And on top of all this, it is a receiver which, in the hands of the ordinary listener, is about as safe as regards oscillation as any receiver can be.

We should have thought that the B.B.C. would have made it their duty to investigate most carefully the "N" circuit receiver. They cannot plead that they have not heard of this receiver. Sir Oliver Lodge, at our last meeting in the Central Hall, referred to it in the presence of Captain Eckersley himself, and the recent Press publicity has made the invention familiar in name to the public.

We would ask Captain Eckersley if he has done anything in the matter. If the B.B.C. wants to stop oscillation they must adopt some such device, and they must plan a

the rights to publish articles dealing with it. Further, at Sir Oliver Lodge's request, we have tested this receiver. If the B.B.C. do not consider our test satisfactory, let them test it themselves; but let them investigate it. We are certain that Sir Oliver Lodge would be only too pleased to give them the opportunity.

Appeals to the public, and reiterated cries of "Please don't do it" will never stop the oscillation nuisance.

We understand that the B.B.C. have recently planned out a campaign, or at least have been discussing a campaign, to stop the oscillation nuisance. If it is going to consist of wordy propaganda of the usual type, it is doomed to failure.

In conclusion, we very strongly recommend the B.B.C. to get in touch with Sir Oliver Lodge and to urge their engineers to investigate a type of circuit which we know to be admirably suited to listeners in this country, and which, of all the simple receivers yet devised, is the most suited for the reduction of the oscillation nuisance. Talk will not help; get on with the job.

HOW TO USE VALVE CURVES

PART I.—IN THE OPERATION OF VALVES.

By C. E. FIELD, B.Sc.
(Staff Consultant)

VALVE characteristics are nothing to be frightened about. On the contrary, they provide us with a great deal of valuable information without troubling us with a lot of figures or mathematical expressions.

Although many amateurs believe that valve characteristics are beyond their

it shows the relation between the temperature and the time, and might be called the characteristic curve of the patient in question.

The most important valve curve is that which shows the relation between the voltage applied to the valve grid and the current flowing in the plate circuit.

Since the grid voltage is produced by incoming signals, and it is the plate current which gives rise to the sound in our headphones or speaker, or which passes on signals to the next valve, it is evident that the relation between these two quantities will determine how a valve is going to behave when put in circuit.

In Fig. 1 is shown a sample valve characteristic of this type.

It will be seen that the paper on which it is drawn is divided into squares, one side of a square measured horizontally representing one volt on the valve grid, either positive or negative, and one side measured vertically representing one milli-ampere of plate current, the numbers being indicated, for convenience, on the thick line passing through 0 grid volts.

Grid Voltage.

Before going any further, let us be quite clear as to what we mean by grid voltage and plate current.

By grid voltage is meant the voltage which exists between the grid of the valve and the end of the filament which is connected to the negative low-tension terminal. Thus, in Fig. 2, which represents the last valve of a receiving set, the grid voltage is that which would be measured by a suitable

voltmeter connected between the points V_1 and V_2 , and not between V_1 and V_3 , or V_1 and V_4 .

The plate current is the current which, in this case, flows from the valve, through the headphones, to the high-tension battery, and could be measured by a milliammeter inserted at the point A. (A milliampere, by the way, is one-thousandth of an ampere.)

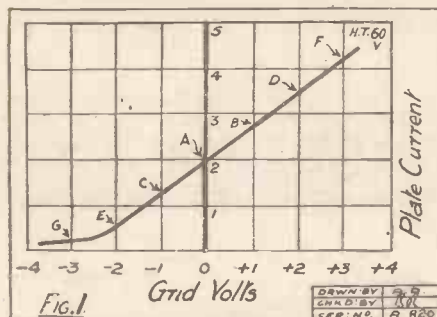
A Practical Example.

Let us suppose that the curve in Fig. 1 has reference to the valve shown in Fig. 2.

Before any signals are received, the grid is at the same voltage as the filament negative, for they are joined together through the transformer winding. That is to say, the grid voltage is zero, and is therefore represented in Fig. 1 by the point A, where the characteristic cuts the line drawn through 0 grid volts.

It will be seen that this point corresponds with the 2-milliampere mark on the plate current scale, which means that there is a steady current of this value flowing through the headphones.

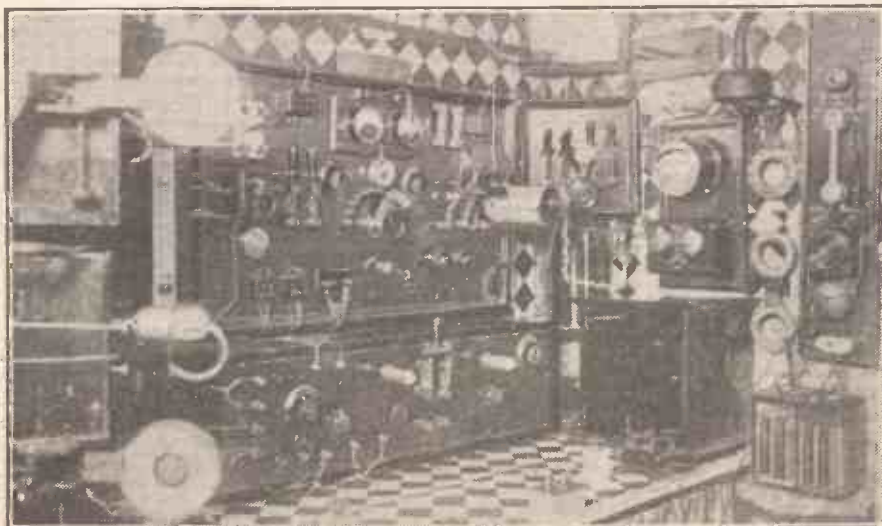
Imagine now, that signals are received which at their maximum value change the potential of the grid by one volt in either



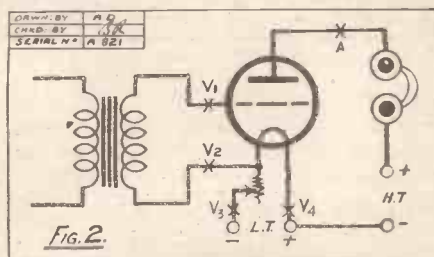
comprehension, they would have no difficulty in understanding a temperature chart in a sick-room. Yet there is no essential difference between these curves. (Characteristics, curves, graphs, and charts are only different names for the same thing).

A graph is simply a picture which shows at a glance the relation between two variable quantities, one of which is changed by, or depends upon, the other.

A temperature chart, for example, shows us just how the patient's temperature has varied during the day, or, in other words,



The well-arranged amateur transmitting station built by Mr. Denis R. Watts, 56, Station Road, Handsworth, Birmingham.



direction. Then the grid voltage will vary between +1, represented in Fig. 1 by the point B, and -1, represented by the point C. At these two points the plate currents, read from the vertical scale, are $2\frac{1}{2}$ and $1\frac{1}{2}$ respectively.

Distorted Results.

Thus, the signals have caused the telephone current to vary by $\frac{1}{2}$ milliampere in either direction.

If the signals increased until the grid voltage varied between +2 and -2, shown by points D and E, the plate current would then vary by $1\frac{1}{2}$ milliamperes each way, fluctuating between $3\frac{1}{2}$ and $1\frac{1}{2}$.

(Continued on next page.)

HOW TO USE VALVE CURVES.

(Continued from previous page.)

Now let us see what happens if the signals become still stronger, and change the grid potential by three volts in either direction. The grid voltage will now be varying between the points F and G on the curve, corresponding to plate currents of 4.25 and 0.2 milliamperes. The maximum increase in current is now 2½ milliamperes, but the maximum decrease is only 1.8, so that equal changes in grid voltage do not produce equal changes in plate current, as they did before the signals became so strong.

This indicates that the telephone current no longer faithfully follows the voltage changes set up by the incoming signals, and distorted results are obtained.

We could have told this from a glance at the curve, however, without considering actual figures, for the lack of proportionality causing the distortion is indicated by the bend at the bottom of the curve to the left of the point E.

As a first step, then, we may say that the signals must

potential on the grid by forcing electricity on to it, the latter is drained away to the filament, and the grid voltage is kept at a low value.

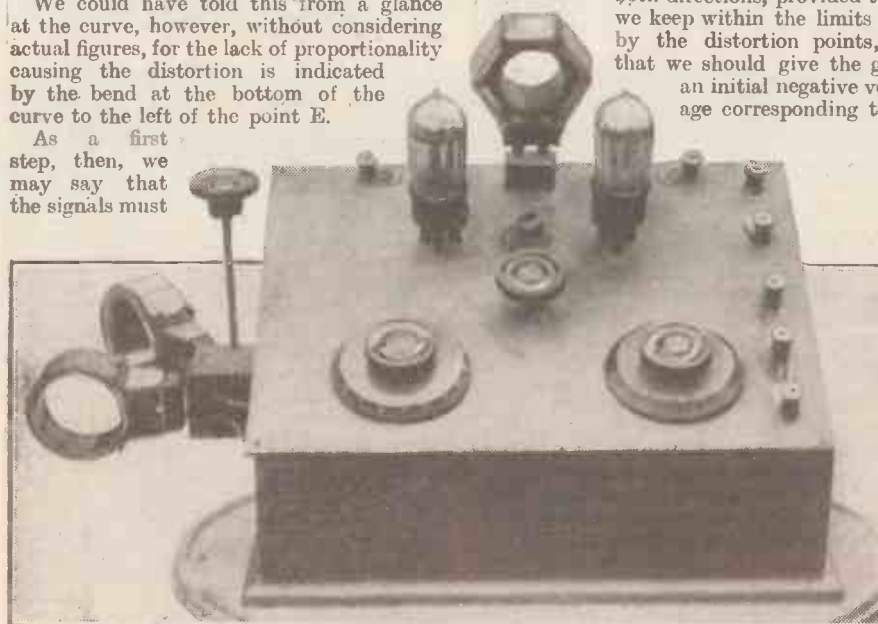
Therefore, although an increase of one volt on the grid produces the same change in plate current as a decrease of one volt, as shown by the curve, the same signal which gives a negative impulse of one volt will not succeed in making the grid one volt positive, on account of the flow of grid current.

We must therefore not allow the grid to become at all positive.

Referring to Fig. 1, we may say that distortion is produced when the peaks of grid voltage pass to the right of the point A and to the left of the point B, which we will call the two "distortion points" of the characteristic.

Determining Grid Bias Values.

In order to obtain the maximum signal strength without distortion we must obtain the maximum changes in grid voltage in both directions, provided that we keep within the limits set by the distortion points, so that we should give the grid an initial negative voltage corresponding to a



A straightforward but effectively designed two-valve set built by a "P.W." reader.

not be allowed to change the voltage of the grid to such an extent that it cannot be represented by points which lie on the straight portion of the curve.

Grid Current.

There is another factor to take into consideration, however, which very much modifies what we have just stated.

Reverting to our first example, in which signals changed the grid potential by one volt, giving conditions represented by points B and C, let us consider more fully what happens when the grid is made one volt positive.

The positive potential will have exactly the same effect as that on the valve plate, and will attract electrons from the filament, thereby causing what should be plate current to flow from grid to filament in the form of grid current. This current is extremely small (only a few thousandths of a milliampere), and does not of itself seriously rob the plate circuit of current, but it does rob the grid of voltage, for, as fast as signals try to increase the positive

point midway between the two. In the case shown in Fig. 1 we should require a negative voltage, or grid bias of one volt, represented at the point C.

When we see a valve curve, therefore, for a low-frequency amplifier, all that we need to do is to put in the two distortion points—one on the line through zero grid volts, and the other at the beginning of the left-hand bend—and find the point midway between these two. That gives us the best value of grid bias to employ for the valve in question, operated with the plate voltage stated on the curve.

When the valve is used as an H.F. amplifier, grid bias is not usually necessary, for the signal impulses are so small that the flow of grid current may be neglected.

Another important fact which we learn from the curve shown in Fig. 1 is this. When no negative bias is employed, the average steady current from the high-tension battery is 2 milliamperes. When the valve is operated correctly at the point C, this current is reduced to 1½ milliamperes, the drain on the battery being almost halved.

RADIO IN SUMMER-TIME.

DURING the summer months aerial overhauls can be carried out. Doubtful halyards can be replaced, and insulators cleaned, and the wire itself can be examined. The lead-in and aerial earthing arrangements can be inspected and cleaned up if necessary.

But there is something which is really more important than all this, and that is the earth. Water-pipe earths do not vary, but buried earths are liable to lose efficiency during dry spells unless they are very deep. Reception falls off in the summer owing to the ionisation of the atmosphere, and inevitably certain distant stations will recede into the great summer silence, while even nearer stations will come in less readily, but results will not be hopeless while there is still a good earth—and, of course, a good aerial and a good set!

Prolonging Battery Life.

The ground in the vicinity of a buried earth should be well watered, while, although a good buried earth with a fairly short earth lead of stout gauge is generally to be preferred to a water-pipe earth, the latter can give the former points when the ground becomes hard and dry. There are patent earth devices available, such as Hedge's, which are designed to retain moisture, and in hot weather these score heavily above the ubiquitous biscuit-tin.

A wireless set and its batteries should be kept away from the sun as much as possible, otherwise ebonite warpage and other troubles will be encountered. The batteries, indeed, should be kept in a cool place. When the set is not in use it is well worth while removing them, and taking them down into a cellar or placing them in a cool corner on the stone or cement floor of the scullery. H.T. battery life especially can be greatly prolonged by such means.

Artificial Atmospherics.

It cannot be too often repeated that an accumulator must be charged at regular intervals, even although it is not being used or is only being used for short and infrequent periods. At least once a month it should be handed over to the charging station. If it is not to be used for a period of two or three months, it should be fully charged, the acid emptied out, and then carefully washed out with distilled water. It can then be left for an indefinite period without fear of the dreaded sulphation occurring.

Summer-time is lightning-time, and whether the set is in constant use or not the earthing-switch should always be employed when thunder is about.

Atmospherics, too, will be prevalent, and before blaming the receiver for causing harsh, grating noises, the effect of removing the aerial and earth leads should be noted. If the noises still continue, then the set is at fault; if not, the atmosphere is the culprit, and nothing much can be done to reduce the interference.

In common with valve sets, crystal receivers will appear to lose efficiency during the summer for previously mentioned reasons, but the loss will be minimised by providing an "earth" of optimum efficiency.



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5. H.F. (Tuned Anode) AND CRYSTAL, WITH REACTION.
6. H.F. AND CRYSTAL. (Transformer Coupled, Without Reaction).
7. 1-VALVE REFLEX WITH CRYSTAL DETECTOR (Tuned Anode).
8. 1-VALVE REFLEX AND CRYSTAL DETECTOR (Employing H.F. Transformer, without Reaction).
9. H.F. AND DETECTOR (Tuned Anode Coupling, with Reaction on Anode).
10. H.F. AND DETECTOR. (Transformer Coupled, with Reaction).
11. DETECTOR AND L.F. (With Switch to Cut Out L.F. Valve).
12. DETECTOR AND L.F. UNIDYNE (With Switch to Cut Out L.F. Valve).
13. 2-VALVE REFLEX (Employing Valve Detector).
14. 2-VALVE L.F. AMPLIFIER (Transformer coupled with Switch to Cut Out Last Valve).
15. 2-VALVE L.F. AMPLIFIER (Transformer-Resistance Coupled with Switch for Cutting Out Last Valve).
16. H.F. (Tuned Anode), CRYSTAL DETECTOR AND L.F. (with Switch for Last Valve).
17. CRYSTAL DETECTOR WITH TWO L.F. AMPLIFIERS (with Switching).
18. 1-VALVE REFLEX AND CRYSTAL DETECTOR, with 1-VALVE L.F. AMPLIFIER, Controlled by Switch.
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0005 "	1/6
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P29



The Mihaly Television Scheme

BRIDGING space and time is one of the main problems of the human mind.

The invention of ever more perfect means of transport has enormously accelerated both passenger, goods and mail traffic on land and water and in the air, telegraphs are sending written records, and telephones human speech over practically unlimited distance. Wireless broadcasting makes music and speech accessible to any number of listeners, gramophones are preserving the voice for future reproduction, and film records fixing for the human eye any event or scenery. In fact, there is only one missing link in this chain of scientific marvels—viz., a television device making any event at the very moment it is occurring visible at any number of places, and enabling, for instance, two persons talking over the telephone not only to hear, but to see one another.

While the first approach to such an achievement—viz. the telegraphic transmission of pictures over conductor lines, or by wireless, has been made for some time, the television problem itself—i.e. the transmission of moving scenes, is still waiting or, rather, has until quite recent times been waiting for a definite solution.

A Very Difficult Problem.

In fact, some promising experiments in this line have lately been made in several countries, and a young Hungarian inventor, Dionys von Mihály, claims to have found a fully workable scheme which would only require the expenditure of a few thousand pounds to carry out in actual practice. Pending its final realisation, the scheme is represented by an experimental transmitting and receiving outfit installed at the premises of a Budapest telephone company.

It has recently been my good fortune to meet the inventor, who at the present time is staying in Berlin, and to discuss with him the various aspects of the problem and learn how ingeniously the practical difficulties so far baffling all constructors of television devices have been overcome.

While the television problem at first sight closely resembles that of telephotography, this similarity on closer inspection is found to be only apparent. Though the underlying principle is the same, all the practical conditions that television is based upon are incomparably more difficult, and cannot possibly be realised with the resources of telephotography. The following survey of the principle of picture transmission will bring out more clearly the enormous difficulties that have to be overcome in connection with any television scheme.

A special article about a specially interesting subject—Television—and how a Hungarian inventor thinks it can be accomplished.

By Dr. ALFRED GRADENWITZ.
(Our Correspondent in Berlin.)



M. Dionys von Mihály.

Every picture is made up of a large number of dots of various luminous intensities placed loosely apart or close to one another. A certain magnification enables these picture elements to be distinguished in any half-tone. These elements have to be transmitted one by one, being converted at the transmitting station into electric fluctuations by means of some photo-electric device—e.g. a selenium cell giving out for the brighter dots heavy electric impulses, and for the darker ones some weaker impulses of proper intensity which by wireless waves are transmitted to the receiving station.

Primary Requirements.

After arriving at the receiver, the impulses have to be reconverted into luminous dots and arranged in the same order as at the transmitting station—i.e., in accordance with their actual intensities. If, now, these rows of dots or picture elements be recorded by projection on a sensitive film, the sequence of portions of variable luminous

intensities will reproduce the original picture transmitted by telegraphy.

While this is the common principle of both problems, the following are some individual differences: Whereas in the case of telephotography the original picture, by means of a suitable lamp, is lighted as strongly as may be desired, the luminous intensity in the case of television cannot as a rule be increased, the original picture being the image thrown by the objective on the frosted glass plate of a photographic camera. Moreover, the time available for the decomposition of a picture into dots or elements, their conversion into current impulses and the transmission of the latter to the receiving station is practically unlimited (being—e.g. for the Korn process, about 6 minutes), whereas the whole operation—i.e., the transmission and appearance of the original picture should in the case of television occur so rapidly that our eye is unable to separate the various impressions. Mihály may justly claim the merit of having solved satisfactorily all the individual tasks involved by the television problem, while eliminating at the outset any scheme impracticable from a physical point of view.

Five Essential Processes.

The following individual tasks have accordingly to be performed by any television apparatus:

1. Decomposing the picture into elements. This involves the problem of the luminous intensity of the original picture.
2. Converting the various picture elements into current impulses.
3. Possibilities of transmission.
4. Reconverting any current impulses as received at the other end into picture elements.
5. The problem of synchronisation—i.e. of simultaneously working the picture analyser and receiver. These problems are discussed in the following:

Inasmuch as no picture can be transmitted integrally, they should be decomposed into their various portions or picture elements. If, for instance, a 10 x 10 centimetre picture is to be transmitted in 1 sq. m.m. elements, corresponding to a rather coarse sub-division, this would be equivalent to about 10,000 picture elements, the picture being at first decomposed into 1 mm. parallel bands, and eventually into 1 sq. mm. squares. These picture elements in accordance with the above are converted into current impulses by means of a photo-electric attachment, the selenium cell. Such a selenium cell could fitly be termed an "electric eye," seeing, perceiving and recording everything.

(Continued on next page.)

THE MIHALY TELEVISION SCHEME.

(Continued from previous page.)

Selenium is an element related to sulphur and which in its grey crystalline variety possesses an electric resistance variable according to the light projected on it. The more intense this light the lower will be its resistance—i.e. the greater will be the current intensity allowed to enter the circuit. The more feeble the light, on the other hand, the greater will be the resistance and the lower the electric current conduction.

All cells prepared with selenium, of course, show the same phenomenon, and inasmuch as a picture is made up of a sequence of component parts or elements of greater or less luminosity, the selenium cell which under the impact of light alters its electric resistance, allows a current of varying intensity, in accordance with the variable brightness of picture elements, to pass, thus enabling these variations to be recorded. Whereas in the case of telephotography the conversion and transmission process takes about six minutes or 360 seconds, the picture elements or current impulses in the case of television should be made visible simultaneously, being transmitted at a sufficient rate for our eye to merge them into a single impression.

A Specially Designed Oscillograph.

In order, therefore, to carry out any television scheme in actual practice, selenium cells of practically no inertia had to be devised, with a surface area not exceeding that of an individual picture element—i.e. about 1 sq. mm., while the efficiency of the selenium, to comply with actual requirements, had to be increased enormously.

Finally, there had to be designed some device enabling the current impulses as transmitted at the rate of 100,000 per second, to be reconverted into picture

As regards, first, the apparatus decomposing the picture into individual elements, this had long been in existence. However, though a decomposition into 10,000 elements also takes place in the case of telephotography, television entails too rapid a decomposition (within one-tenth second) to allow the same apparatus to be used. Nor could



An experimental television transmitter constructed in accordance with Mihaly's system.

that apparatus, if operated at a properly increased speed, be employed in the present case.

Inasmuch as any possibility of effecting the sub-division of a picture by mechanical means was out of the question, Mihaly from the very outset adopted an oscillograph arrangement, viz., a system of two thin platinum or silver cords carrying in their centre a minute mirror and placed in a magnetic field, which on the passage of even the slightest electric current, undergoes a fluctuation. An outfit such as this is capable of performing as many as 50,000 vibrations per second. Even Blondel's needle oscillograph was able to reach this frequency, though with rather considerable current impulses (0.3 ampere). In fact, the oscillograph is a suitable electro-optical apparatus, the mirror of which is able to perform much higher frequencies than required in connection with television. Mihaly eventually adopted the oscillograph mirror not only as secondary, but even as primary decomposer.

It is seen from the above that with the farthest-going decomposition the organs of conversion rather than the picture decomposer play the most important rôle.

One of the most important points to be considered in this connection is the inertia

of selenium cells. Many hypotheses have been advanced to account for it, but the actual reason of inertia had not so far been ascertained. Now, the fact that certain selenium phenomena not connected with any apparent inertia are known to occur suggested the possibility of so improving the design of selenium cells as to reduce their inertia to practically nil. Whereas the usual type of selenium cell on a rather extensive surface comprises 2-3 electrodes, the new cell designed by Mihaly has no less than 42 electrodes to each square milli-

metre, which, when viewed under the microscope with a 60-fold linear magnification, are seen to be absolutely parallel.

This solution enables a far greater sensitivity to be reached than any of the photoelectric cells based on the electro-motive force given out by potassium, aluminium, etc., which have been used by other inventors, but which, in the case of such minute variations of luminous intensity, and high frequencies as required for television, are even less suitable than a poor selenium cell.

A Sensitive Relay.

The oscillograph and light relay used to record these slight variations of luminous intensity and to reconvert the corresponding current impulses into fluctuations of light had to be designed specially for the purpose. Though some of the well-known types of oscillograph, Blondel's needle instrument, for instance, were able to record up to 50,000 variations per second, they would only respond to relatively strong current impulses. The Siemens's bifilar oscillograph, on the other hand, will respond to minute variations but its frequency is very low (10,000 to 15,000 per second).

Mihaly's oscillograph combines the characteristics of both of these types and enables very high-frequencies to be recorded with extreme accuracy, the oscillograph strings by means of four micrometric screws being brought to within a distance of from one to two-hundredths of a millimetre of one another.

The light relay designed in connection with this oscillograph allows the current impulses given out by the new selenium cell combined with two to three-valve amplifiers to be recorded up to a frequency of one hundred-thousand per second. In order to utilise these linear displacements in releasing a relay, a projection screen is provided through the opening of which the beams reflected from the oscillograph mirror are arrested in its position of rest and allowed to pass in greater or less quantities according to the deflection of the mirror. The beam of light passing through the opening is projected on to a corresponding area by a synthesising mirror.

(Continued on next page.)



A photograph of some letters taken during their reception on a Mihaly receiver.

elements. And all these processes—decomposing the picture into individual elements, converting these into current impulses, transmitting the impulses to the receiving station, reconvert them into picture elements, arranging them in proper order, and causing the picture to appear—had to be carried out within one-tenth of a second.

Another problem difficult of solution was the simultaneous working of the transmitting and receiving stations—i.e. their synchronisation.

THE MIHALY TELEVISION SCHEME.

(Continued from previous page.)

Now, as regards the transmission of impulses from the selenium cell of the transmitting station to the recording oscillographs of the receiving station, any wireless transmitting and receiving apparatus for short waves is quite suitable for the purpose, the selenium cell working with only fifty to one hundred volts.

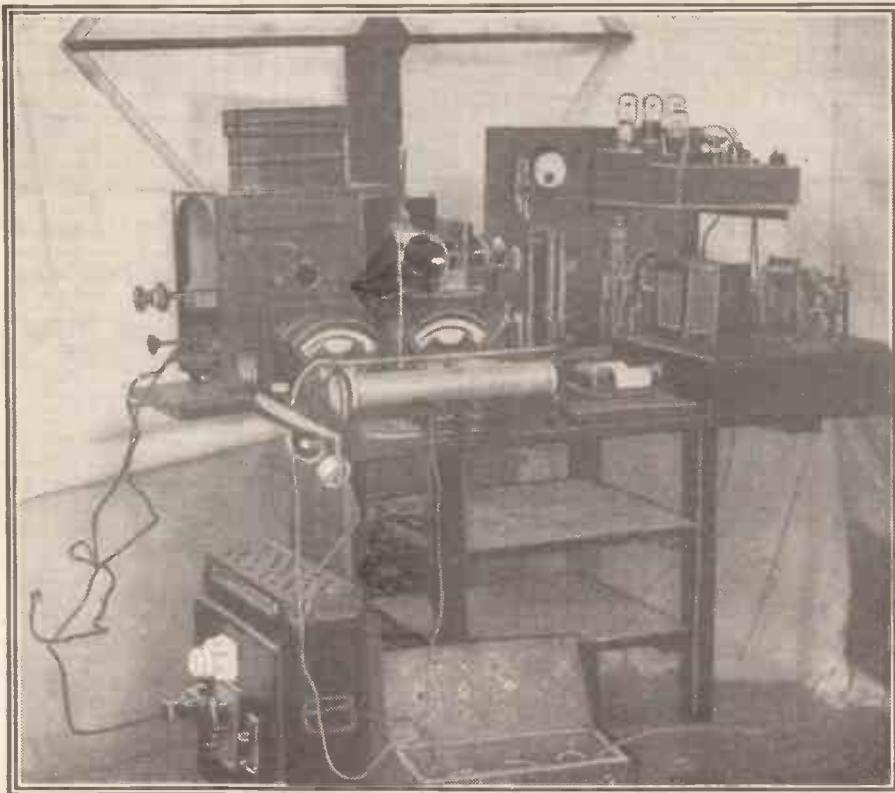
The synchronising of frequencies of the transmitting and receiving apparatus respectively was effected by means of a La Cour tuning fork interrupter (phonetic wheel). As regards the synchronism of phases, this was secured by allowing during the transmission of pictures, for periodic breaks marked in the transmitter by opaque spots and reproduced on the

were too coarse and too few in number. The first tests were made over a distance of 100 kilometres, and geometrical figures, letters, the outlines of village scenery, the silhouette of a person moving in front of an objective at a transmitting station, etc., were made visible, thus showing that every part of the apparatus was working in an efficient manner.

A Practical Proposition.

The various portions of an apparatus to be used in actual practice have been worked out, comprehensive tests showing that apart from financial difficulties, there is absolutely no reason why this apparatus should not embody all the qualities required from an actual television outfit.

Wireless television is likely before long to revolutionise much of our life, bringing about the most desirable changes in its daily course. Science, trade and industry, journalism, advertising, etc., will all profit by practical television.



The receiving section of "Mihály's" experimental television apparatus.

receiver screen. Any disturbance of synchronism can be made up for by causing these breaks to agree with the markings on the reproduction screen.

Successful Tests.

It is seen from the above that the problem of television has to all intents and purposes been solved, and though the apparatus designed by Mihály, and known as his "Telehor," is still somewhat complicated, there is no doubt but that a short time will be sufficient to simplify and improve it so as to allow of its being adopted in actual practice.

The first experimental outfit constructed by Mihály could not yet be used for any practical purposes, as the picture elements

L.F. COUPLINGS.

Resistance Capacity.—This method is slightly cheaper than transformer coupling, and gives purer results than many of the badly designed transformers on the market. The fact that the anode impedance does not vary with frequency limits the distortion to that actually produced by the characteristic of the valve. The disadvantages of this method are: (1) the lower amplification per valve, three resistance-capacity valves being about equal to two

good transformer-coupled valves, and (2) the greater value of H.T. voltage required (90 to 150 volts, or more).

Anode resistances for this method of coupling should be wire-wound to ensure good results with a silent background, and the value of both anode resistance and grid leak should decrease for each successive stage, to allow for the increased grid-voltage swing and the consequent lower filament-plate impedance of the valve. Suitable values for three stages are 100,000, 80,000, and 60,000 ohms for the anode resistances, and 2, 1, and 0.5 megohms for the grid leaks.

Transformer Coupling.—Despite the many advocates of resistance coupling for L.F. valves, transformer coupling is still the most popular type, and is likely to become even more so now that manufacturers are at last turning their attention to the actual design of L.F. transformers, instead of copying well-advertised but poorly designed makes. The high degree of amplification obtainable is an undoubted asset to the amateur, effecting a saving in valves, L.T. and H.T., whilst the purity of reproduction can be quite as good for the same volume, provided that well-designed transformers are employed.

Inefficient Transformer Designs.

Many articles have appeared in the wireless press from time to time dealing with the cause of distortion in L.F. transformers, and this has been generally attributed to hysteresis in the iron. Research in connection with loading coils for telephone cables has shown the possibility of practically eliminating this cause. Most of the distortion present in these components is due to badly designed windings. Many of the transformers on the market, including some well-advertised makes, are wound with comparatively large wire to effect economy in manufacture, and as a consequence have an inadequate number of turns in the primary winding. This results in an excessive magnification of the higher harmonics, and consequent distortion.

Points Worth Noting.

It can be shown that, for maximum efficiency, the impedance of the primary winding should be equal to the filament-plate impedance of the valve, whilst for purity of reproduction it should be larger than the valve impedance. Care should therefore be exercised in the choice of transformers to ensure obtaining a sufficiently high primary impedance, and transformers should be bought on the basis of the number of turns in the windings, a good transformer having at least 25,000 turns in the two windings. The overall size of a transformer is no criterion of its value, many of the smaller transformers having more turns than the large ones; whilst small transformers are easier to mount and offer less chance of interaction, as well as lessening the losses caused by their proximity to high-frequency fields.

Another frequent cause of distortion is badly proportioned winding forms, which are generally made so that the length of winding is several times the depth. This results in high capacity between layers, and consequent marked resonant frequencies. Transformer coils should be of flat type.



Traders and manufacturers are invited to submit wireless sets and components to the "P.W." Technical Dept. for test. All tests are carried out with strict impartiality in the "P.W." Test room under the supervision of the Technical Editor, and the general reader is asked to note that this weekly article is also intended to provide a reliable and unbiased guide as to what to buy and what to avoid.—EDITOR.

TWO NEW OSRAM VALVES.

D. E.8 H.F., fil. volts, 5-6-6; fil. current, .12 amperes; anode volts, 120 max., amp. factor, 16; impedance, 25,000 ohms.

D.E.8 L.F., fil. volts, 5-6-6; fil. current, .12 amperes; anode volts, 100 max.; amp. factor, 7; impedance, 8,000 ohms.



The Dubilicon fixed condenser device known as the "Dubilicon" which enables a large range of capacities to be obtained.

The two new Osram valves whose specifications are given above are of more than usual interest in view of the very low amperage at which they are rated. They are dull emitters in the true sense of the word, and only a very small accumulator is necessary to run even three or four of them.

The H.F. type is recommended as a detector and should be followed by resistance, choke or low-ratio transformer coupling. Due to the high amplifying properties of the valve, the makers recommend the adoption of some form of neutrodyne circuit in order to prevent instability when it is used in H.F. positions. On test we did not find the D.E.8 H.F. particularly instable despite its undoubted sensitiveness. We were able to use it both in a straight H.F. position and as a "Super Het." intermediate with something around 50 volts H.T., and obtained excellent results notwithstanding the absence of neutrodyne.

In a detector position the D.E.8 H.F. gave results truly comparable with that well-known rectifier, the Osram D.E.5B., as the manufacturers claimed it would, so with its

greatly reduced current consumption it is a valve that strikes a very distinctive note.

The D.E.8 L.F. operated very efficiently in the various L.F. positions in which it was tested. When the two types were employed in their respective positions in a straight det.—L.F., volume and tone were both above reproach, and a very satisfactory example of efficient "team work" was evinced. The G.E.C. people have indeed increased their already varied "Osram" range of valves in a noteworthy manner.

COMPREHENSIVE CONSTRUCTOR'S KIT.

Messrs. The Express Radio Service, Factory Square, Streatham, S.W.16, are supplying a kit of parts, including a drilled panel and blue prints, suitable for building any one of the 20 "P.W." blue print receivers. The price is £12, and while we have not examined the outfit, this figure appears to be very reasonable.

A NOVEL ACCUMULATOR ACCESSORY.

From Messrs. A. F. Bulgin & Co., 9-11, Cursitor Street, Chancery Lane, London, E.C.4, we have received a number of Deckorem Anti-Corrode Accumulator Vaseline Cups. Sold in pairs at 1s. per pair, they consist of small lead castings and coloured washers. They are fitted in the following manner. The terminals and lock-nuts are removed from the accumulator and the coloured washers put on, the blacks on negatives and reds on positive. Then the lead "cups" with their recesses filled with vaseline are slipped on, and finally the lock-nuts and terminals are replaced. The whole device is only about an $\frac{1}{8}$ in. in thickness, and is as neat in appearance as it is efficient in design. Readers who have hitherto regarded the corroding of accumulator terminals as an inevitable process of dissolution should give this new Bulgin product a chance to prove otherwise.

A NEAT PLUG AND SOCKET.

Messrs. J. J. Eastick & Sons, of Eelex House, 118, Bunhill Row, London, E.C.1, recently sent us some of their plugs and sockets, arranged by means of insulating connecting bars to form twin plugs. The result is very pleasing, both in appearance, due to their bright, distinctive colours, and in the smooth, perfect contacts provided. The price of a complete twin plug and socket is 9d., and for either battery or 'phone connections we can think of few other devices as suitable. Messrs. Eastick inform us that they make connecting bars for their plugs up to eight-way, and that these are non-reversible, and can be used for multi-battery connections.

PROOF OF POPULARITY.

The Athol Engineering Co. inform us that their books show that over a quarter of a million Athol Reversible Valve Holders are now in use. This is a remarkable proof of popularity considering that the device was, comparatively speaking, but recently placed on the market.

THE EDISWAN "HYMEG" H.T. ACCUMULATOR.

The Edison Swan Electric Co., Ltd., recently sent us a sample 60-volt Ediswan "Hymeg" H.T. accumulator. Its design is refreshingly original and it incorporates a number of features of outstanding interest. For instance, a high insulation is obtained between the cells by means of horizontal and vertical ribs moulded on the sides of the little glass containers. Also the use of separators has been eliminated by the provision of further ribs inside, which hold the plates apart. It is stated that the nature of the paste and the design of the plates are such that there are no dangers of "shedding" taking place.

Thus no item figures inside the little cells other than the plates and the acid solution. Each cell connector is provided with a socket so that even the plug adjustments can be made in steps of two volts.

The capacity of the "Hymeg" is stated to be 2 ampere hours at the 10-hour rate, which indicates that anything up to .2 amps. can be taken from it quite safely for a period of 10 hours. Naturally, on a four or five milliamp. discharge its capacity would be greater, and Messrs. Ediswan are to be congratulated for specifying the high rate, when it would be so easy to talk in "point 0-0's."

On a test discharge at .1 amp. we obtained slightly over 3 amperes hours, and this is a good indication of the sort of safety margin the manufacturers have allowed. Messrs. Ediswan inform us that the cells have been designed to stand on open circuit for exceptionally long periods without fear of sulphation, and that charging need only be carried out at from four to six months intervals, providing that the battery has not become discharged in the meantime.

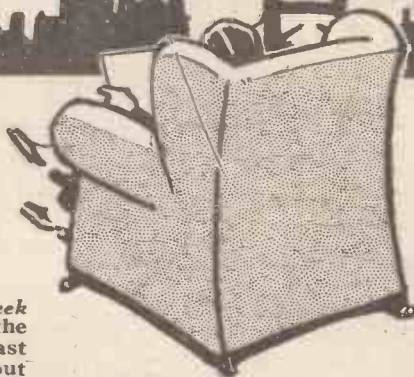
"Hymegs" are supplied in hard wood cases treated with an anti-sulphuric preparation and fitted with stout leather carrying handles. Wander plugs and fillers are provided. The list price is 10d. per volt for any even voltage from 24 volts up and is, in our opinion, very reasonable indeed. Grid bias batteries of similar construction consisting of six cells are also available.



The pulpit of Bath Abbey showing the Marconi microphone in position.



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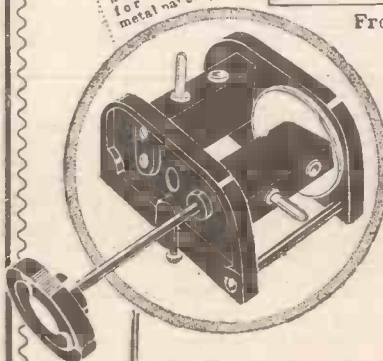
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The Editor will be pleased to consider articles and photographs dealing with all subjects appertaining to wireless work. The Editor cannot accept responsibility for manuscripts and photos. Every care will be taken to return MSS. not accepted for publication. A stamped and addressed envelope must be sent with every article. All inquiries concerning advertising rates, etc., to be addressed to the Sole Agents, Messrs. John H. Lile, Ltd., 4, Ludgate Circus, London, E.C.4.

As much of the information given in the columns of this paper concerns the most recent developments in the Radio world, some of the arrangements and specialities described may be the subject of Letters Patent, and the amateur and the trader would be well advised to obtain permission of the patentees to use the patents before doing so.

Readers' letters dealing with patent questions, if sent to the Editor, will be forwarded to our own patent advisers, where every facility and help will be afforded to readers. The envelope should be clearly marked "Patent Advice."

TECHNICAL QUERIES.

Letters should be addressed to: Technical Query Dept., "Popular Wireless," The Fleetway House, Farringdon Street, London, E.C.4.

They should be written on one side of the paper only, and MUST be accompanied by a stamped addressed envelope.

Queries should be asked in the form of the numbered questions: (1), (2), (3), etc., but may be accompanied by a short letter giving any necessary additional particulars as briefly as possible.

For every question asked a fee of 6d. should be enclosed. A copy of the numbered questions should be kept, so that the replies may be given under the numbers. (It is not possible to reproduce the question in the answer.)

BLUE PRINTS. A series of 20 Blue Prints can be obtained from the Query Dept., price 6d. per Blue Print.

Only a limited number of circuits are covered by this series, and full details of the circuit arrangements available in Blue-Print form are published fortnightly in the advertisement columns of this journal.

All other back-of-panel wiring diagrams are specially drawn up to suit the requirements of individual readers, at the following rates: Crystal Sets, 6d. One-Valve Sets, 6d. One-Valve and Crystal (Reflex), 1s. Two-Valve and Crystal (Reflex), 1s. Two-Valve Sets, 1s. Three-Valve Sets, 1s. Three-Valve and Crystal (Reflex), 1s. 6d. Four-Valve Sets, 1s. 6d. Multi-Valve Sets (straight circuits), 1s. 6d. Except SUPER-HETERODYNE DIAGRAMS, all of which, irrespective of number of Valves used, are 2s. 6d.

If a panel lay-out or list of point-to-point connections is required, an additional fee of 1s. must be enclosed.

Wiring diagrams of commercial apparatus, such as sets of any particular manufacture, etc., cannot be supplied. (Such particulars can only be obtained from the makers.)

Readers may submit their own diagrams, etc., for correction or for criticism. The fee is 1s. per diagram, and these should be large, and as clear as possible.

No questions can be answered by 'phone.

Remittances should be in the form of Postal Orders.

Questions and Answers

RINGING NOISES.

M. R. (Southampton).—I am troubled with "ringing" noises in my set and should be pleased if you could inform me as to the best treatment to overcome them.

The trouble of which you complain is unfortunately common to many sets and is due in most instances to the valves, which are said to be "microphonic." The noises are caused by relative movements of the plate and grid of the valve, set up by the slightest shock or vibration.

(Continued on page 624.)

Build the "Suburban" Three Receiver

(Described in last week's issue.)

THOUSANDS of "P.W." readers have benefited by the unique PILOT service for home constructors, and are now the proud owners of handsome and efficient sets, superior to many factory built ones costing three times as much. Briefly, the scheme is this:—We supply you with all the parts for any of the "P.W." or other well-known

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66/3 buys all the parts

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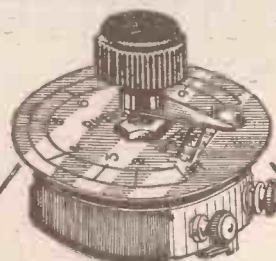
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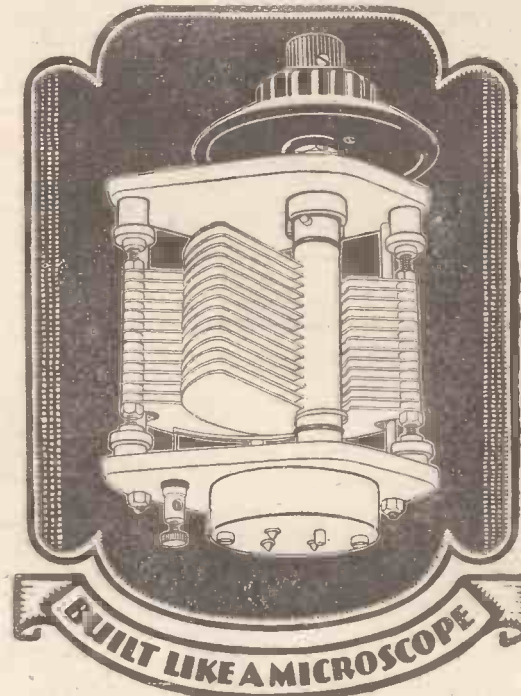
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RADIOTORIAL QUESTIONS & ANSWERS.

(Continued from page 622.)

Early types of dull-emitter valves were the worst offenders in this respect, but modern valves are not so microphonic. The effect is most pronounced in sets employing dual or reflex amplification and in ones having multi-stage L.F. amplifiers.

The only satisfactory remedy of overcoming the trouble is to mount the set on something soft such as a piece of felt or baize and then mount the whole on a table or cabinet that does not vibrate when knocked.

Further, all valves, whether arranged on a base-board or panel should be mounted in special "anti-phonic" or "anti-microphonic" valve holders, as these avoid any jar to the electrodes when the set is knocked.

We do not advise you to mount valves on panels that are screwed to vertical ones unless such panels are firmly fixed, like "baseboards."

As a final hint, you are advised to keep the loud speaker away from the set, as with very great volumes the vibrations set up in the former are transmitted to the receiver and so cause a recurrence of the trouble.

EARTH CONNECTIONS.

A. S. (Northampton).—What is the best earthing arrangement on a receiving set, and would two or more earth leads give better results than one?

The lead from the earth terminal on the set should be as short and direct as possible, of the same wire as used for the aerial lead-in (usually heavy rubber covered flex) and should have a large metallic contact with moist earth.

A water-pipe generally makes an excellent earth providing the lead is taken to the pipe that runs direct to the mains in the street. A large metal plate or sheet of heavy copper gauze buried several feet deep in moist earth is very efficient.

Gas-pipes are not advised as "earths," mainly owing to their poor electrical conductivity (due to red lead being used at joints to prevent leakage of gas).

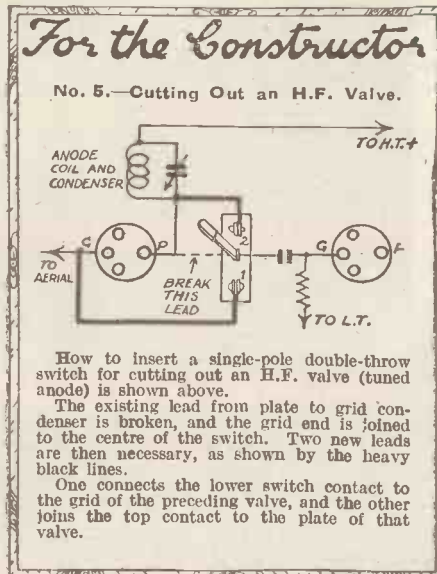
Unless the wires used for more than one earth were of exactly the same length, you would be at a disadvantage, as probably you would experience

"double tuning" on your set. (A station could be tuned in on your variable condensers at more than one spot on the dials).

Therefore, providing your present earth is a good one, there would be no advantage gained by adding another.

H.T. SMOOTHING CONDENSERS.

T. L. (Brighton).—Having experienced bad crackling noises, which I have discovered



originated at the H.T. battery, I wish to place fixed condensers across the various H.T.appings on my set to minimise them. What are suitable capacities?

Any capacity between .5 and 2 microfarads can be used successfully for this purpose. If the set con-

sists of three or more valves we advise the lower capacity condensers (providing more than one positive H.T. tapping is employed), but if the receiver only utilises one common positive H.T. terminal a condenser having a capacity of 2 mfd. is advised.

SCRATCHING NOISES IN SET.

T. T. (Plymouth).—What are the probable causes of scratching noises in my receiver?

The trouble is usually due to either a faulty H.T. battery (a fairly large fixed condenser will cure this), a loose connection, gassing accumulator, or excessive oscillation due to too much reaction.

RANGE OF SINGLE-VALVE SET.

S. L. (Chingford).—I intend making an ordinary single-valve set and should like to omit, if possible, the reaction coil. What would be the range of the set (1) with reaction and (2) without reaction?

With reaction, a single-valve set has a range of about 60 miles (from a B.B.C. station) and about 200 miles from 5 X X.

Without reaction, the range is not much greater than that obtained with an ordinary crystal set, and 20-30 miles would be a maximum figure.

Further, the volume obtained in the latter case would only be about equal to that from the crystal set, so that you would gain no advantage in using a valve set in the circumstances.

LOUD SPEAKER ON CRYSTAL SET.

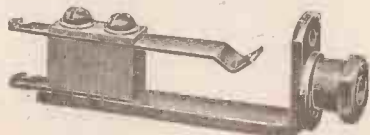
T. M. L. (London).—Would signals be sufficiently strong enough on a crystal set to operate a small loud speaker clearly at about four miles from 2 L O?

An ordinary crystal set by itself will not produce sufficiently strong signals to work the ordinary type of loud speaker with any degree of success, but there is now a loud speaker on the market which operates on the microphone amplifier principle and which will work satisfactorily with a good crystal set.

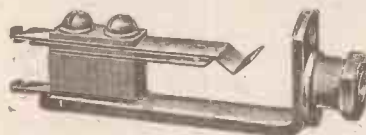
Failing the above amplifier, one of the ordinary valve type called a low-frequency amplifier can be added to the crystal set, with the loud speaker as a separate unit.

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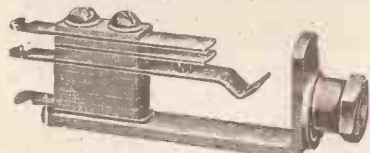
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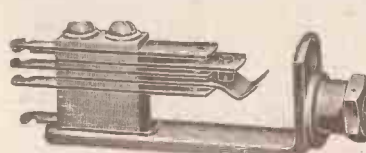
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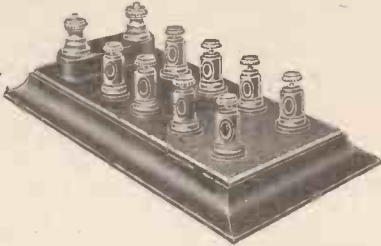
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Both of the above lines are manufactured by the makers of the world-famous "Brownie" Wireless Crystal Receiver (Model No. 2). Price 10/6 complete.

For Summer Radio use the "Brownie" Distribution Board.

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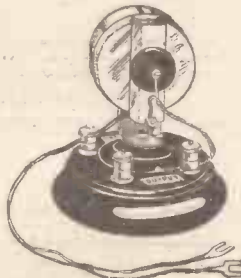
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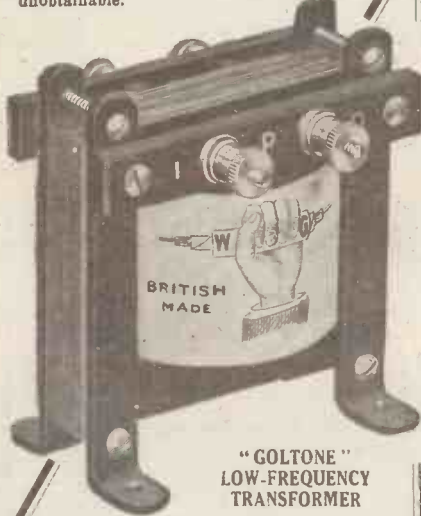
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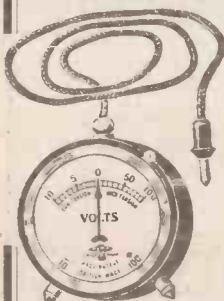
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Extracts from "Wireless Weekly," November 25th, 1925 —

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HOME-MADE ATMOSPHERICS!

From a Correspondent.

A GREAT number of listeners are apt to jump to the conclusion that all the crackles they hear in their headphones or loud speaker are entirely due to atmospherics, and consequently unavoidable. Although this is often true enough, it is surprising what a large percentage of these noises may sometimes be traced to faults in the set itself or, more particularly, the H.T. battery.

Whenever crackling noises are present, and there is the slightest doubt as to their origin, the set should be switched on with aerial and earth leads disconnected. If the crackles remain as loud and persistent as ever, then it may safely be assumed that the trouble lies somewhere in the apparatus itself.

H.T. Battery Noises.

The H.T. battery is most likely to be the culprit, for if this is badly run down it may create enough disturbance to completely mar the reception. The battery should be tested with a voltmeter if one is available. But if you do not possess one, and your friends resolutely refuse to lend you theirs, you will find that a lamp of suitable voltage will indicate fairly accurately the condition of the battery.

If the plate current is derived from 4 1/2-volt pocket-lamp refills, these may be tested with an ordinary small flash-lamp. Should it fail to light, or only glow dimly, the faulty block should of course be removed from the battery and replaced by a new one. When the test reveals a faulty cell in a large tapped battery, the cell should be eliminated from the circuit. This may be done by short-circuiting, or by breaking the connections and joining up the two cells on either side so as to isolate the faulty one.

Noises arising from defective or run-down H.T. batteries are particularly noticeable when L.F. amplification is being used. Reception is often silent whenever the set is first switched on, but noises make their appearance after a few minutes working. This is due to the fact that dry cells tend to recuperate a little when they are not being used, but become noisy again as soon as a little current has been taken from them.

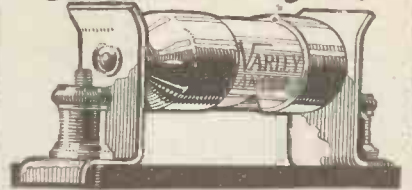
Some Other Causes.

If nothing appears to be wrong with the H.T. battery, it is as well to examine the set itself before definitely blaming lightning for the unpleasant background of crackles that may be spoiling your reception. Inefficient grid leaks are sometimes responsible for noisy reception, and the effect of substituting a new leak should be tried.

Breaks or loose connections of any kind in the internal wiring of the set frequently cause loud scratching noises which resemble atmospherics. The wiring should be gone over, and any faulty joints re-soldered. If connection is made by means of nuts, it is particularly important to make sure that these are tightened up thoroughly. Sets that have been wired up with flex often develop scratching noises due to a strand of

(Continued on page 627.)

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Largest valve-repairing firm in the world. List Free

Correspondence

Letters from readers discussing interesting and topical wireless events or recording unusual experiences are always welcomed, but it must be clearly understood that the publication of such does in no way indicate that we associate ourselves with the views expressed by our correspondents, and we cannot accept any responsibility for information given.—Editor.

The Editor, POPULAR WIRELESS.

Dear Sir,—As a new reader of your paper, I take this opportunity of congratulating you upon the extremely varied nature of the articles and of their general utility to the amateur constructor. In particular, the article by Sexton O'Connor, "Radio-frequency Balancers," in issue No. 209 of the 5th Inst., is most illuminating, and many, no doubt, will alter their existing "tuned anodes" in conformity with the main principles dealt with in this article. It may, therefore, probably help these persons if you could arrange to publish a working diagram and circuit on the general lines of Fig. 4 in the article mentioned above, as the circuit, as it at present stands, appears incomplete, leaving the grid of the valve free as regards the escape of electrons back to the filament. I am, of course, aware that the circuit is only intended to illustrate a point, and is not intended for practical application as it stands.

My private views on the subject are that the inclusion of two condensers, in series, to tune one coil is, to say the least of it, expensive; the object of modern designers should be to simplify and cheapen, not unduly complicate and render expensive the "hobby of the million." Your set, the "P.W." Provincial Two, is a case in point. It is certainly simple and economical, and from the lay-out would appear to be capable of giving good results, not so some of the circuits which I have seen published, though they were not in your paper. There is one small criticism to which I would call your attention: The grid of V1 is connected via the A.T.I. to L.T. +, presumably to stop oscillation, but as you are using a crystal as a rectifier, this would appear to be unnecessary, owing to the heavy damping introduced into the anode circuit.

In conclusion, I should like to say that these criticisms which I have made are not intended in any hostile or "superior" manner, but rather as one who sees things apparently contrary to accepted practice.

Yours faithfully,
A COLCHESTER READER.

The Editor, POPULAR WIRELESS.

Dear Sir,—I had occasion to put a set into a new cabinet a few days ago, and experienced difficulty in arranging for the reversing of the reaction from the coil holder to the front panel. Seeing that the coil holder was behind the panel on baseboard it meant that the leads were to come out to two points on the panel where two sockets were needed, also for the complete "change over." Now if both coil holder and coils were so standardised so that the plug or pin is removable, say on the principle of "Clix," would it not be better to just reverse this pin, instead of having to drill the panel and prepare flex leads, wander plugs and sockets? In addition to this, my experience is that no matter how neatly these are arranged they would certainly be neater by absence.

I may add that this reversal of reaction was rendered necessary by the fact that provision was needed to cut out the H.F. valve. I, of course, considered the inclusion of a D.P.D.T. switch, which could have been quite efficient, but a S.P.D.T. was already on the panel to switch the grid condenser over to aerial or grid.

May I conclude by offering "P.W." readers any copy of "P.W." which may be needed for the cost of postage to their address, and wishing "P.W." continued success,

Yours faithfully,
A. J. THOMPSON.

4, Pollard Street,
Kettering.

HOME-MADE ATMOSPHERICS.

(Continued from previous page.)

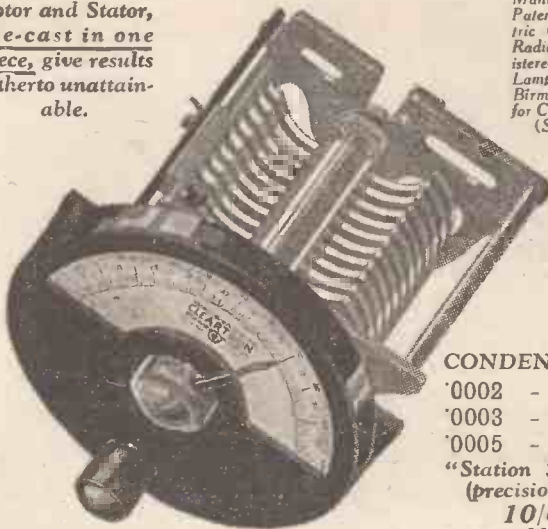
wire rubbing against a terminal with which it is not intended to make contact.

A break in the 'phone or loud-speaker leads is especially troublesome, and often causes loud crackles without actually preventing reception altogether. The leads are most liable to break close up to the earpieces or at the fork where the leads from the two earpieces are joined.

Condenser plates which scrape together, faulty rheostats, and bad contacts in switch-arms and other moving parts are among the remaining causes of crackling and scratching noises in a set.

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**Rotor and Stator,
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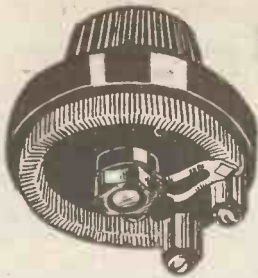
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CT/50

TECHNICAL NOTES.

(Continued from page 606.)



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from mutual interference than the wave-length difference, since the frequency-difference necessary for the avoidance of interference is more or less independent of the frequency (or is believed to be so), whereas the wave-length difference depends upon the wave-length.

Perhaps it may be useful, in concluding these observations on wave-length and frequency, to remark that the velocity of waves (whether wireless waves or any other kind of waves) is equal to the frequency multiplied by the wave-length. Or, in other words, if the velocity is constant, the frequency and wave-length are inversely proportional to one another. Taking the velocity of wireless waves in free ether as being 300,000,000 metres per second in round figures, it will be seen that if the waves have a frequency of 1,000,000 vibrations per second, the wave-length will be 300 metres. A kilocycle is a 1,000 vibrations per second, so that a frequency of 1,000,000 will be described as a 1,000 kilocycles. Thus a wave-length of 300 metres corresponds to 1,000 kilocycles.

Portable Aerials.

I do not know how many of my readers have made up portable or semi-portable sets in which the aerial is a small loop-aerial contained within the cabinet. I recently made some interesting experiments with such a set in which reaction was used (by means of an extra turn or two wound on the loop-aerial pegs) and obtained some quite interesting results in the variation of the number of turns on the reaction coil.

In this particular case the aerial itself consisted of about fifteen turns of wire on a frame roughly a foot square. The reproduction was found in some cases to be better when the reaction only consisted of one turn, whilst in other cases this had to be reduced to about half-a-turn. The curious point was that under certain conditions (which would take too long to go into at the moment) the circuit was sensitive to the smallest variation in the number of turns (or the percentage of a single turn) on the reaction coil. For example, in another case, a very considerable improvement in the performance of the set was noticed when the reaction coil was enlarged from half a turn to six-tenths—an increase of only one-tenth of a turn.

It would be interesting to have readers' experiences of reaction used with a frame aerial in this way, as there is a good deal of difference of opinion as to the sensitivity and quality so obtainable.

Improving Loud-speaker Tone.

A reader sends me an enthusiastic letter about improved results which he has obtained from his loud speaker by shunting a condenser across the grid and plate of the last valve; this, he claims, made reproduction much purer in quality. The first condenser used was a fixed one, 0.0001 mfd. capacity, and although this functioned fairly well, it reduced the volume. He finally employed a large variable condenser instead, and found that the capacity of this condenser could be adjusted to advantage in receiving different selections. Instrumental selections required an adjustment

which was different from that required for vocal selections.

I may say that there is nothing novel in the use of a condenser in this way, and although it may have good results in some cases, it will not necessarily be an advantage in all. However, any reader who has a variable condenser handy which is not required for any other purpose may be interested to try the experiment.

Reading Morse.

An interesting suggestion is received from Mr. T. J. Lewis, of Glamorganshire, who states that after Daventry has closed down he frequently listens-in to Morse, but not being able to read same or, at any rate, being able to read it only very slowly, he is unable to follow the signals. He suggests that if some constructor could produce a very simple arrangement for causing the electrical impulses from the set, or the sound from the telephones, to operate (through a relay, for example) some device which would print the dots and dashes on a travelling strip of paper, these could then be deciphered at leisure by the aid of a Morse alphabet. This, of course, is precisely what is done in the commercial Morse recording instruments, but at the same time if some very simple and readily and cheaply constructed arrangement could be devised, no doubt a large number of experimenters would find it interesting to make up the same and to operate it after the broadcasting had ceased. Perhaps readers who have any suggestions to make in this connection will be good enough to forward them.

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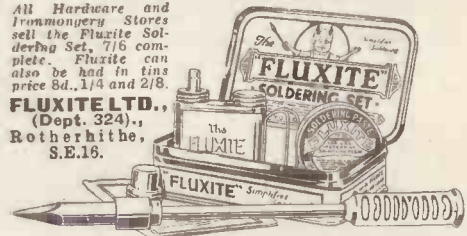
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